WATER & SEWAGE WORKS

WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL

AUGUST, 1932

Section of Sanitary Eng. Research Laboratory,
Univ. of California Sanitary Engineering Research Project

LOCK JOINT

...in the heart of the GREAT LAKES REGION

SERVICE TO THE HIGHLY INDUSTRIALIZED GREAT LAKES REGION is the main purpose of Lock Joint's permanent manufacturing plant on the outskirts of Detroit. Specializing in pipe 24" in diameter and larger for water supply lines, distribution feeder mains, cooling water or process water lines, subaqueous intakes and outfalls, the Detroit plant is ideally situated to serve such nearby industrial centers as Chicago, Cleveland, Gary, Akron and Toledo. Because of this convenient location, pipe from the Detroit plant can be economically shipped to other parts of the country, as well.

AUGMENTING THE DETROIT OPERATION are our three other modern permanent pipe manufacturing plants. Each of these plants is strategically located to serve the rest of the country East of the Rockies. The Wharton, N. J., plant covers the East; Columbia, S. C., the South; and Turner, Kansas, the Great Plains. No matter how large or small your contracts may be, if your pipe requirements are 16" in diameter or larger, you can rest assured that the efficient and economical answer to your pipe problem can be supplied from one of these four Lock Joint Plants.

SCOPE OF SERVICES—*Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipes of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.*

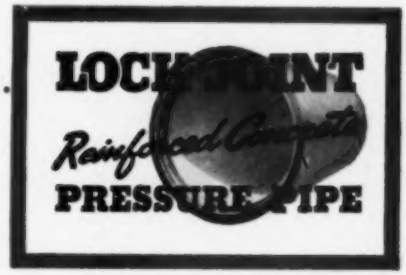
LOCK JOINT PIPE COMPANY

Established 1905

P. O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS: Wharton, N. J., Turner, Kan., Detroit, Mich., Columbia, S. C.

BRANCH OFFICES: Casper, Wyo. • Cheyenne, Wyo. • Denver, Col. • Kansas City, Mo. • Valley Park, Mo. • Chicago, Ill. • Rock Island, Ill. • Wichita, Kan. Kenilworth, N. J. • Hartford, Conn. • Tucumcari, N. Mex. • Oklahoma City, Okla. • Tulsa, Okla. • Beloit, Wis. • Hato Rey, P. R. • Caracas, Venezuela



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Series A-635
Gravimetric Fluoridator

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S-76

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WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL
INDUSTRIAL WASTE TREATMENT

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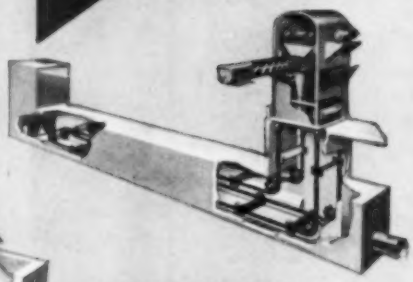

Rex V-Bucket Type Grit Collectors for Deep Channels combine a scraper collector and a bucket elevator in a single unit. This often permits direct discharge into trucks without manual handling of grit.

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DEPENDABLE WATER SERVICE

for Birmingham's 18,000

Residents of Birmingham, Michigan *have* a dependable water service—thanks to farsighted city fathers and engineers who saw fit to provide 1,300,000 gals. of Horton elevated water storage for commercial and domestic use.

With a water supply derived from deep wells, a lack of such storage could put Birmingham at the mercy of a mechanical or electrical failure. Such a failure would pose a serious problem.

The city solved this problem with three strategically located Horton elevated tanks. The first was installed in 1926—a 300,000-gallon ellipsoidal-bottom structure. A 500,000-gallon radial-cone bottom tank was installed in 1942 and another 500,000-gallon radial-cone was put in service in 1951.

Many cities like Birmingham have discovered that Horton elevated tanks reduce pressure variations and cut down pumping costs. Add easy maintenance and modern appearance and it is understandable why Horton elevated tanks are serving so many communities.

Horton elevated water tanks are built in standard capacities ranging from 15,000 to 3,000,000 gals. For complete details or quotations, write our nearest office.

Above: A 500,000-gal. Horton radial-cone bottom elevated water tank erected at Birmingham, Michigan in 1951.

Left: 500,000-gal. Horton radial-cone elevated water tank built for Birmingham, Michigan in 1942. These structures are designed in accordance with AWWA specifications.

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CHICAGO BRIDGE & IRON COMPANY

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Detroit 26	1501 Lafayette Bldg.	Tulsa 3	1625 Hunt Bldg.
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Water Treatment Plant

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(COMPLETED IN 1950)

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Delta Finishing Co.

Builders-Providence Equipment furnished for the Delta Finishing Co. Water Treatment Plant:

- 8" Rate-of-Flow Controllers with Loss-of-Head and Rate-of-Flow Gauges
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- Clearwell Depth Gauge
- Filter Operating Tables and Sampling Tables
- Basin Level Control Unit
- Wheeler Filter Bottoms

To provide the essential raw material for finishing rayon and cotton piece goods — a process water of high purity — is the job of this modern water treatment plant at the Delta Finishing Co., Division of J. P. Stevens & Co., Inc, Up-to-date in every detail, the plant supplies 1½ MGD max. of finished water, free from turbidity and of controlled chemical purity.

By assuring itself of a water supply of constant quality, this major textile finishing plant can maintain product quality of an unusually high character.

The same operating problems encountered in a modern municipal water works had to be dealt with at this plant. Here, as in so many other water works throughout the country, Builders Flow Metering and Controlling Equipment has been installed to assist in plant operation and to insure high operating efficiency under all conditions. This equipment was installed by the contractors, Daniel Construction Company, Inc., of Greenville, S. C. For Bulletins describing Builders Water Works Equipment, address Builders-Providence, Inc. (Division of Builders Iron Foundry), Providence 1, Rhode Island.

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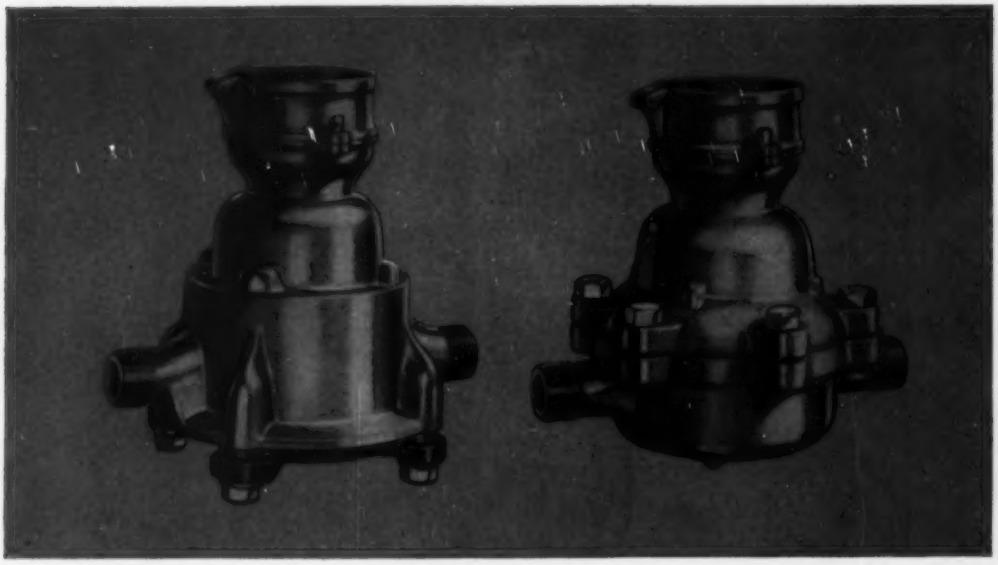
Instruments

BUILDERS

Badger Stands for more than Meters



Badger means complete meter Service

Yes, you'll find every type and size of meters in the complete Badger line . . . but you get *more than meters* from Badger. You get complete meter service: ● Dependable recommendations for every water-measuring need . . . Badger-engineered and precision-built mechanical features that assure you full revenue by unfailingly recording every drop of water used . . . rugged quality that means maximum service life, minimum maintenance, lowest year-in and year-out water-metering costs ● You get successful Badger background of nearly half a century . . . meter installation and servicing counsel . . . meter-reading features that save time and money . . . efficient Badger Meter Testing Machines, and many Badger-engineered exclusive advantages ● For complete meter service, you'll find it pays to contact Badger.

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First for Accuracy • Low-Cost Maintenance • Durability • Sensitivity

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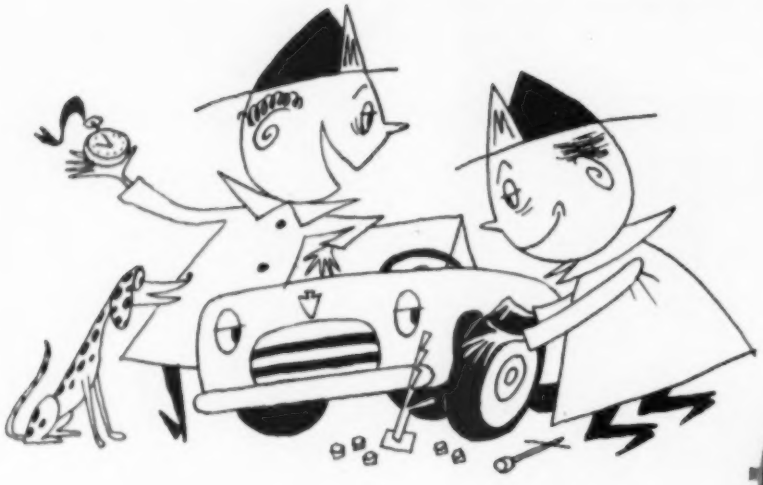
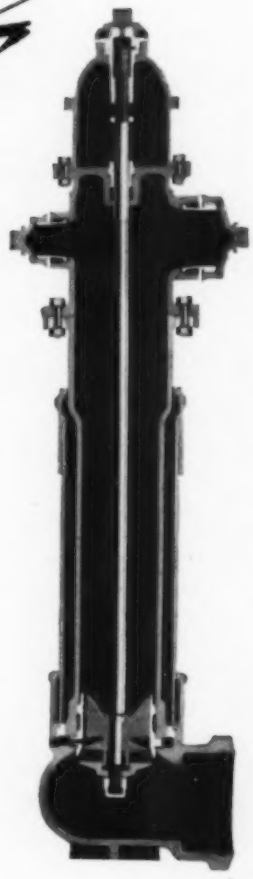
Quick as changing a wheel



When a Mathews Hydrant is broken in a traffic accident, two men can put in a new barrel in a matter of minutes—*without excavating*. Speed of replacement is important when community safety is at stake.



MATHEWS HYDRANTS

Made by R. D. Wood Company Public Ledger Building, Independence Square, Philadelphia 5, Pa. • Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

Mathews Modernized Hydrants . . . Tops in Convenience and Dependability Compression-type valve prevents flooding • Head turns 360° • Replaceable head • Nozzle sections easily changed • Nozzle sections raised or lowered without excavating • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity • Operating thread only part to be lubricated • All working parts contained in barrel • A modern barrel makes an old Mathews good as new • Available with mechanical joint pipe connections

TYLOX JOINTS

CUT INFILTRATION 90% UNDER SPECIFICATIONS IN NEW OKLAHOMA CITY SANITARY SEWER PROJECT

BENHAM ENGINEERING CO., top ranking consulting engineers, knew they faced a tough infiltration problem in engineering Oklahoma City's 25 mile main and sub-main sanitary sewers. Over 10 miles of ditch had to be dewatered since it lay 2 to 3 feet below the normal water table.

How to make sure of minimum infiltration under such circumstances? Wisely the engineers specified Tylox, the flexible rubber joint that has earned the reputation of being "leakproof for the life of the line."

They set up in their specifications that infiltration could not exceed 10,000 gpd per mile of sewer. But even the engineers and contractors on the job, Earl W. Baker & Co., were surprised to see infiltration held to 870 gpd per mile of sewer, 90% *less than specification* limits.

On that next "tough" sewer problem — be sure. *Specify TYLOX flexible-rubber JOINTS.*

THUMBNAIL FACTS ABOUT OKLAHOMA CITY'S SANITARY SEWER PROJECT

Southwestern Main Sanitary Sewer
5.94 miles 2' to 3' below water table
36", 42", 48", 54", 60" Bore concrete pipe, 4500 lb. 12' lengths

Mid-Urban Main Sanitary Sewer
2.95 miles 2' to 3' below water table
33", 36", 54", 60" Bore concrete pipe 4500 lb. 12' lengths

Deep Fork Relief Sanitary Sewer
5.99 miles (no dewatering necessary)
24", 27", 30", 33", 36", 42", 66" Bore concrete pipe, 12' lengths

North Canadian River Bottom Sub Main Sewer
1.30 miles 2' to 3' below water table
24", 33", 36", 42", 48" Bore concrete pipe, 6' and 12' lengths

Sub Main Sanitary Sewers
3.80 miles (no dewatering necessary)
24" concrete pipe, 6' lengths

Benham Engineering Co.
Consulting Engineers in charge
Earl W. Baker & Co.
Contractors

1644

MAKING JOINTS WITH TYLOX RUBBER GASKETS IS AS SIMPLE AS ABC

Cement tongue and snap on Tylox gasket.

Lubricate sliding surfaces with Tylox Cement.

Shove the pipe home.

Write, wire, or phone for Specification Data and Literature on Tylox Gaskets.

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"THE ONLY PERMANENTLY TIGHT LINES ARE LAID WITH RUBBER JOINTS"

16" diameter, thirty-five-foot long Cook Well Strainer made of Everdur being installed at Fort Knox, Kentucky.

How's this
for putting brains to work?

For more than 70 years, Cook Well Strainer Company, Inc., of Lawrenceburg, Indiana, has been making well strainers. For many of these years slotted seamless brass tubes, up to 12" diameter, proved wholly adequate. But the insistent demand for more and more water called for deeper wells of larger diameter—and strainers to meet the new needs.

The basic features of the famously successful tube strainer—direct inlet; self cleaning slot, larger inside than outside; one metal; strength; rigidity—would have to be duplicated in larger diameters.

Why not a wire-wound strainer with automatically-made *mechanical* bonds? Indeed, why not? The illustrations on this page show the practical application of this ingenious idea. Cook Wire-Wound Well Strainers are now made in sizes up to 40" inside diameter—at high speeds, with slot widths readily variable, and lengths limited only by handling facilities.

Two Anaconda Metals, Red Brass-24 and Everdur*-1010 Copper-Silicon Alloy, have proved themselves outstanding for this application. Both machine readily, are plenty tough to withstand upsetting, contribute strength for the required rigidity, and provide excellent resistance to a wide variety of corrosive ground waters. Your problems may be different, mechanically or chemically, but if they involve copper, brass or bronze, call on The American Brass Company, General Offices, Waterbury 20, Connecticut. 5208

* Reg. U.S. Pat. Off.

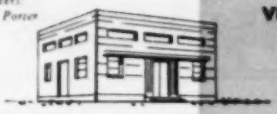
As the supporting skeleton of bars revolves in this winding machine, each bar is machine-notched ahead of the spirally wound wire (see circle illustration). This wire is a special drawn Anaconda Shape of modified keystone cross-section. A circular form tool then displaces the metal on one side of the V-groove into the dovetail section of the wire, locking it securely.

the name to remember

ANACONDA

COPPER, BRASS & BRONZE

Pointe Aux Peaux Station
Consulting Engineers:
Dietz, McNamee & Porter



VERTICAL CONSTRUCTION
is the key to economy
in Monroe's new low
lift pumping station

BJ VERTICAL CIRCULATING PUMPS

Important savings on space and construction costs are achieved by the City of Monroe, Michigan, through a new pumping station built on three levels. Motors and controls are on the ground level, discharge piping on the first sub-level, and impellers in the sump level. This station features Byron Jackson Type DWT Vertical Circulating Pumps designed to operate singly or in combination. Installation proved simple and economical because no dry pit was required as would be the case with horizontal units.

BJ
engineered answers to pumping problems

Inside the control room, at ground level, are the motors and controls for the four main units and the auxiliary sump pumps. The large amount of floor space, due to vertical construction, allows ample room for servicing of all the equipment.

In the pipe room (below the control room) two of the discharge columns may be seen to the left of the main header. They are provided with well seals, with the discharge line located 3 ft. above the floor. Under high water and wind conditions, water in the suction column can rise to 2 ft. above the floor level without any leakage into the pipe room. The pump impellers are submerged below in a suction well level divided into two sections. Pump capacities range from 2100 to 4500 gpm.

Byron Jackson Co.
Since 1872
P. O. BOX 2017 TERMINAL ANNEX
LOS ANGELES 54, CALIF.
Offices in Principal Cities

Why cast iron pipe

can and does save

Millions of Tax Dollars

The answer, of course, is (1) cast iron pipe serves for centuries, and (2) over 95% of the pipe in service in America's water distribution systems is cast iron pipe. But let's get down to figures.

The cumulative cost of our water supply systems, from 1817 to 1951, is estimated at $6-billion, of which more than $3.5-billion is for cast iron pipe, including installation costs. The balance is for pumping stations, filter plants, storage facilities, etc.

Most of this money was raised by the issuance of bonds. Now, the useful life of cast iron pipe is at least 4 to 5 times the average term of a water revenue bond issue. Records prove that more than 35 American cities have cast iron mains in service that were installed over 100 years ago. A survey sponsored by three waterworks associations shows that 96% of all six-inch and larger cast iron pipe *ever laid* in 25 representative cities is still in service.

Add it all up and the answer is clear that, by serving for generations after bonds issued to pay for them have been retired and forgotten, cast iron mains save many millions of tax dollars.

One of a number of cast iron water mains which have been in service in New York City for more than a century. Over 35 other cities have century-old cast iron mains in service.

CAST IRON ®

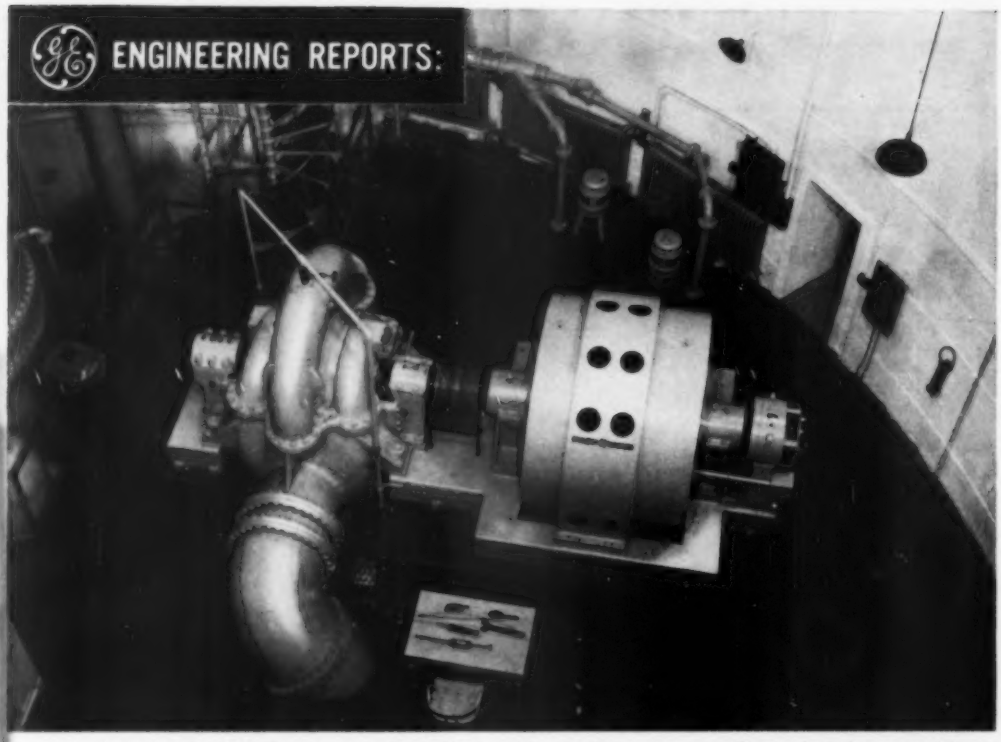
CAST IRON PIPE

America's No.1 Tax Saver

©1952, Cast Iron Pipe Research Association

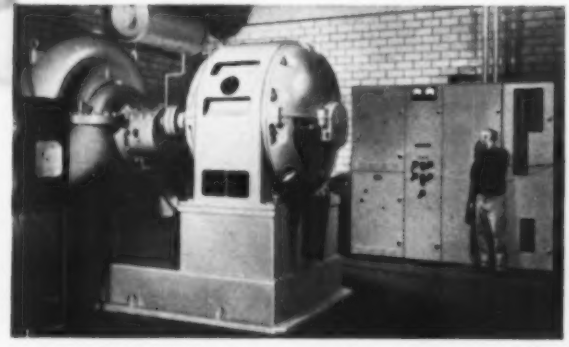
CAST IRON PIPE RESEARCH ASSOCIATION, THOS. F. WOLFE, MANAGING DIRECTOR, 122 SO. MICHIGAN AVE., CHICAGO 3.

ENGINEERING REPORTS:



1. RAW WATER from the Ohio River is pumped in at River Road station at 60 mgd, 200-ft head by a DeLaval pump driven by a new 2500-hp G-E synchronous motor. This new drive is 8 percent more efficient than the steam drive it replaced. Marine Electric Company installed this and other new electric equipment involved in the Louisville expansion.

Louisville modernizes and



5. BOOSTER PUMPING UNIT at Cardinal Hill reservoir consists of this G-E 400-hp, 440-volt induction motor and 40-mgd DeLaval pump. In the background is G-E switchgear for starting motor.

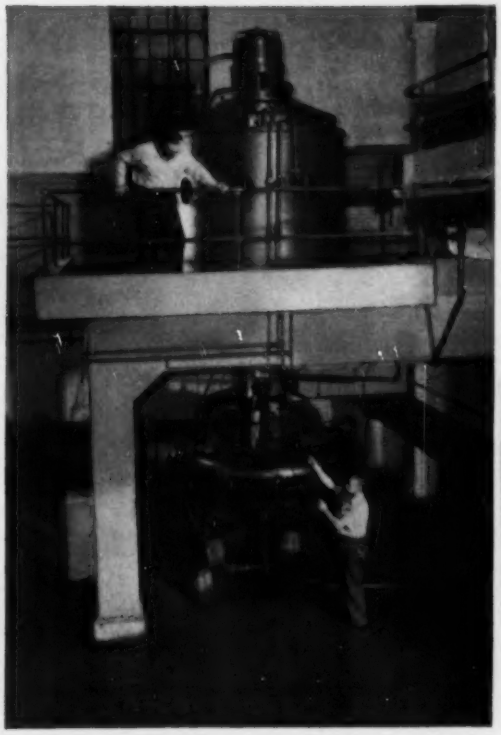
6. G-E TELEMETERING and supervisory control at Cardinal Hill transmits data to Crescent Hill, from which valves and booster pump are operated.

STIMULATE YOUR COMMUNITY'S INTEREST IN WATER SUPPLY

by showing the new color movie "Pipeline to the Clouds." It's part of G.E.'s *More Power to America* Water Supply Program. Write for details on your letterhead to *General Electric Co., Section 666-71, Schenectady 5, N. Y.*

2. STARTER for 13.8-kv motor at River Road is this G-E magne-blast circuit breaker. Chief Engineer Ossman checks switch as G-E sales-engineer L. W. Anderson looks on.

3. AFTER TREATMENT, water is pumped into distribution mains from Crescent Hill high-lift station. New G-E motors for this purpose are controlled by this G-E switchgear.



4. TOTALLING 7000 HP, five G-E motors (one shown) drive DeLaval centrifugal pumps at Crescent Hill. Replacing steam drive, they pump more water at lower unit cost.

expands its water system

New electrical system for city's three plants helps provide low-cost operation, dependable supply, adequate future reserve

To meet a pumping demand that has increased 50 percent in the last ten years, Louisville recently modernized and expanded its entire water works system. Inadequate equipment in the city's three stations was replaced by a modern electrical system. According to Superintendent B. E. Payne, with the new facilities capable of supplying 180 mgd, adequate capacity is assured for many years to come—and at lower unit cost.

Electric equipment for this expansion was supplied by General Electric. In addition, G-E engineers worked closely with city planners, consultants Alvord, Burdick & Howson, and the Dravo Corp., general contractors, to provide Louisville with a co-ordinated electrical system.

Your water-supply program can benefit from this same kind of help. G-E application engineers will work with your engineers or consultants to fit the right electric equipment into a system that meets your particular needs. Call in your G-E Apparatus Sales Engineer early in the planning, when he can help you most.

Engineered Electrical Systems for Waterworks

GENERAL ELECTRIC

Lithographed on stone for U. S. Pipe and Foundry Co. by John A. Noble, A.N.A.

LARGE DIAMETER cast iron pipe, as illustrated, are efficiently serving as water, gas or sewer mains in large cities throughout the country. If this were a water supply line or an intercepting sewer, either bell-and-spigot or mechanical joint pipe might be used; however, for a gas feeder main these days it would most likely be mechanical joint.

Our pipe 30-inch and over, flexible joint and integral flange pipe are all made by the pit cast process. Pipe in sizes 2-inch through 24-inch are cast centrifugally in metal molds with bell-and-spigot, mechanical joint or plain ends. No matter whether pit cast or centrifugally cast, the quality of our pipe is scientifically controlled throughout its manufacture.

United States Pipe and Foundry Co.,
General Offices, Burlington, N. J.
Plants and Sales Offices Throughout the U. S. A.

U.S.
CAST IRON
PIPE

MODERN WATER TREATMENT PLANTS, with Accelators, are saving up to 80% of the space required by "old-style" plants. Primary savings are accomplished by combining mixing, coagulation and clarification in a single unit . . . far less space for the same or extra capacity. This basic design achievement also reduces the installed cost of municipal and industrial water treatment plants whether they require clarification, softening, or combined clarification and softening.

AN EXCLUSIVE TIME-TESTED PRINCIPLE — dynamic separation — increases solids separation rates so that *better* results are obtained in *smaller* basins

(continue to next page)

(continued from preceding page)

than can safely be used with equipment of any other design. Accelator operations actually "squeeze" clarified water out of a *downward* moving pool of slurry! Simply stated, Accelator advantages add up to most effective water treatment in *less space at lower cost*. Over 1800 installations attest to these benefits. Write for complete information on this modern process for water treatment. Ask for Bulletin 1825-B.

INFILCO INC. *Tucson, Arizona*

Field Engineering Offices in 26 Principal Cities • Plants in Chicago & Joliet, Illinois

INFILCO since 1894

Infilco builds a complete line of equipment for municipal and industrial water treatment plants making possible UNIFIED RESPONSIBILITY FOR PERFORMANCE — BACKED BY OVER 50 YEARS' EXPERIENCE.

Accelator*
Acid Feeders
Activated Carbon Purifiers
Aerating Nozzles
Aerators
Aero-Accelator
Aero-Spray Nozzles
Alkalinity Reduction Plants
Aneser*
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Automatic Proportioners
Boiler Feed Treatment Plants
C.-A.-P. Systems
Catser*
Chemical Feeders
Chemical Proportioners
Chemical Test Apparatus
Clarifiers
Coagulant Feeders
Coagulators
Color Removal Plants
Crystalite* Water Softeners
Cyclator*
Dechlorinating Plants
Deionizers
Depth Gauges
Disk Filters
Filter Gauges
Filter Operating Tables
Filter Plant Equipment
Filter Strainers and Nozzles
Filter Underdrain Systems
Fluorex* Purifiers
Gauges, Indicating & Recording
Gravity Filters
Hot-Flow* Water Softeners
Hot Process Accelator
Hydraulic Controls
Hydraulic Switches
Hydrodarco Purifiers
Industrial Waste Treating Plants
Ion Exchangers
Iron Removal Plants
Lime Slakers & Feeders
Lime-Soda Water Softeners
Liquid Level Controllers
Loss of Head Gauges
Manometers
Mixing Basin Equipment
MultiCone Aerators
Odor Removal Plants
Phosphate Feeders
Phosphate Softeners
Pressure Filters
Rate of Flow Controllers
Rate of Flow Gauges
Recarbonators
Sampling Tables
Sand Filters
Sedifloter
Steam Purifiers
Stellar* Filters
Sterilizing Equipment
Swimming Pool Systems
Taste Removal Plants
Vapor Purifiers
Vorti-Floc*
Vorti-Mix*
Wagner Underdrains
Wash Water Controllers
Waste Acid Neutralization Plants
Waste Water Treating Plants
Water Filters for Every Need
Water Softeners of Every Type
White Water Treating Plants
Zeolite Water Softeners

*Reg. U.S. Pat. Off.

PROVED SPACE-SAVINGS!

Here's how Accelators save space in both municipal and industrial water treatment installations.

VERSATILE DESIGN

See how this Accelator installation, 48 feet square, was designed to fit economically into a limited congested plant area to clarify and soften 6 M.G.D. of Monongahela River water for industrial use.

ANOTHER EXAMPLE — INDUSTRIAL TREATMENT PLANT

This paper mill uses clarified river water for process work. Accelators (on extreme left) treat 22 M.G.D. and occupy about ¼ of the space needed by the plant on the right having the same capacity.

ALMOST 10 TO 1 ON AREA COMPARISON

This Accelator, 70 feet square, in upper right of photo, installed in much less space, treats 12 M.G.D. "Old-style" basin treated but 9 M.G.D. and required 205 sq. ft. area.

BIG CAPACITY, SMALL SPACE

"Old-style" plant requires 38,900 sq. ft. and treats 21 M.G.D. Accelators treat 30 M.G.D.— almost ⅓ greater capacity — in about ¼ the space.

ALWAYS THE BEST—FOR DALLAS

Sludge Collectors
Sludge Elevators
Grit Washers
Grit Collectors
Scum Removers
Spiral Conveyors
Screenings Grinders
Garbage Grinders
FLOCTROLS
Rapid Mixers
Bucket Elevators
Chains, Sprockets, Bearings

They do things up in a big way down in Texas, and Dallas is no exception. When it came to specifying the most modern equipment for treating sewage, Jeffrey received the call.

Screens, Grinders, and Grit Collectors . . . combined into a coordinated system to provide an efficient plant for this large and progressive city in the southwest.

We could name you hundreds of cities, as big as and often larger than Dallas, in which Jeffrey sewage and water treatment equipment is performing in a most satisfactory manner. Specify Jeffrey if you want the best . . . the most modern.

CATALOG NO. 833

THE JEFFREY MANUFACTURING COMPANY

1877 75 YEARS 1952

996 North Fourth St., Columbus 16, Ohio

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The Ohio Malleable Iron Co., Columbus, Ohio
The Kilbourne & Jacobs Mfg. Co., Columbus, Ohio

Transite Pipe is a product of modern engineering and research. Shown above is one of the buildings at the Johns-Manville Research Center at Manville, New Jersey.

*Transite is a registered Johns-Manville trade mark

Johns-Manville TRANSITE

TRANSITE PIPE last longer California city streets?

Transite Pipe was first installed by this California city nearly 20 years ago. Its lasting strength and high corrosion resistance have enabled it to outlast pipe previously used several times over.

Research designed it for lasting strength

TODAY, ACROSS THE COUNTRY—under countless city streets like the one shown above—Transite* Pressure Pipe is doing a highly efficient job of transporting water . . . often under conditions so adverse to ordinary pipe that engineers marvel at Transite's ability to stand up through the years!

The reason? *Lasting strength!*

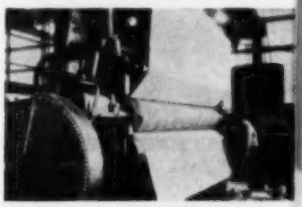
Not only does Transite Pipe have the *initial* strength that's needed in a pipe intended for use under busy city streets. Equally important, it has the *lasting* strength that enables it to survive continued corrosive attack, year after year . . . to keep on giving the same dependable, economical service to the community as the day it was installed.

This highly important quality of lasting strength is one of many notable inherent advantages of a pipe engineered with modern water transportation requirements in mind. Transite's Simplex Couplings reduce leakage losses to a minimum, provide flexibility to help relieve the line of soil stresses and traffic loads. Its light weight makes for easier handling and effects substantial savings during installation. Its smooth interior assures a high coefficient of flow (C=140) and, because Transite can never tuberculate, helps keep pumping costs low through the years.

Why not get all the details . . . find out how this modern-engineered-for-the-job asbestos-cement pipe can help solve your water-line problems and *save you money?* For full information, write Johns-Manville, Box 60, New York 16, N. Y.

JM PRODUCTS

Tough, strong asbestos fibers reinforce Transite Pipe—contribute to its high corrosion resistance and lasting strength.



On machines like this, the asbestos-cement-silica mixture is "built up" under heavy pressure into a dense, homogeneous pipe structure.

Transite's flexible Simplex Couplings help relieve the line of excessive flexural stresses—an added safeguard against pipe failures.

asbestos-cement PRESSURE PIPE

It takes all three to get the best pipe protection

1

The right planning

It pays to have the benefit of experienced technical advice in planning pipe protection. A Barrett technical advisor is available to give you a hand *right from the start.* Through him, you take advantage of Barrett's long years of experience in protecting America's greatest pipelines.

Barrett®

2

The right enamels

Barrett® Waterworks Enamel gives you all these advantages:

Rigid quality control • Prevents tuberculation and incrustation of interior pipe surfaces • Effectively protects external pipe surfaces against corrosion • High dielectric properties • Impermeable to moisture, non-absorptive, non-porous • High ductility and flexibility, shows high resistance to soil stresses • Unusual tenacity • Effective under all kinds of climatic conditions and topography • Service • Availability.

3

The right application

A Barrett Technical Service Representative is available for on-the-job consultation. He'll help you save time and money. Remember: even the finest enamels must be properly applied for proper protection.

and you get all three from BARRETT

Write, wire or telephone for further information about BARRETT pipe-protective products and services.

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 RECTOR STREET, NEW YORK 6, N. Y.

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EDDY CUTTING-IN VALVES AND SLEEVES

Make Installations as Swift and Simple as... A B C

A
The first step is to cut out from the existing line a length equal to the overall distance from face to face of the valve flanges, plus 10 inches. Slip glands and gaskets over the pipe ends and spigot end of sleeve.

B
The next step is to lower the valve into place and seat the exposed pipe end firmly within the valve. The spigot end of the sleeve is then moved along until it has become properly seated within the valve.

C
The final step is to assemble the joints. Tighten nuts gradually, a half turn at a time, moving from nut to nut, until all are uniformly tight. Then make tight the set screws on the sleeve's gland.

Since 1849 EDDY For Long Service

A Starting with step "A" above, two men can install an Eddy Mechanical Joint Cutting-in Valve and Sleeve on an existing pipeline in less than 25 minutes.

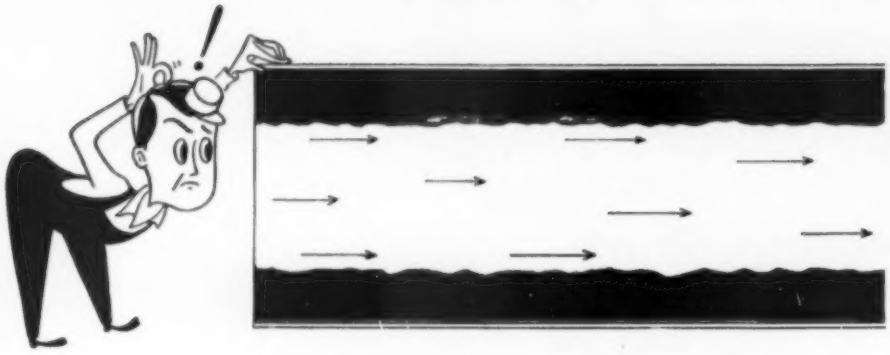
B Every joint holds bottle-tight under pressure. No lead melting or caulking required. Thus, the work can be done in any kind of weather, or in a flooded trench.

C Only a ratchet wrench is necessary for completing the assembly.

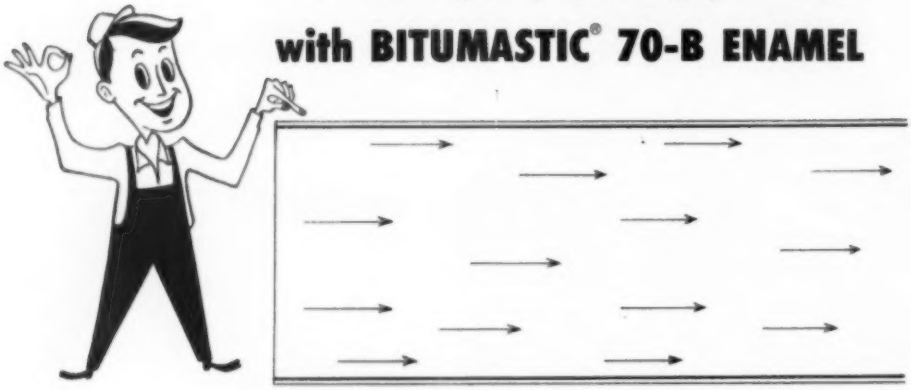
Stock up now with Eddy Cutting-in Valves, and Sleeves, and be ready for speedy, on-the-spot installations as circumstances may permit. Valves meet AWWA specifications; are available in 3 to 12" sizes for sand cast and centrifugally cast iron water pipe. Send for descriptive illustrated folder . . . Form 3-24-51.

EDDY Valve Company *A Subsidiary of James B. Clow & Sons* WATERFORD, NEW YORK

NO WORRY OVER LOW FLOW CAPACITY



...when you protect pipe lines with BITUMASTIC® 70-B ENAMEL



PIPE LINES DON'T "SHRINK" when interior surfaces are coated with a spun lining of Bitumastic 70-B Enamel . . . because this durable enamel *prevents* rust, corrosion, incrustation and tuberculation.

When there's no "shrinkage" of inside diameter, there's no loss of valuable line capacity. Your pumping costs are reduced . . . your pipe line's coefficient of flow *stays* high. It's unnecessary to spend money for *over-sized* pipe in order to allow for anticipated loss in flow capacity.

Further, with a flow capacity *you can count on*, there's no gambling or guessing as to the size of pipe you specify. You select pipe for your water lines solely on the basis of desired capacity.

Bitumastic 70-B Enamel is equally effective in protecting exterior surfaces of pipe lines. It prevents pitting and leakage caused by soil corrosion.

Protect your community's steel pipe lines, inside and out, by specifying Bitumastic 70-B Enamel. Our representative will be glad to assist you in preparing your specifications. If you wish, our Contract Department will handle your coating job for you at the job site. Write for complete information.

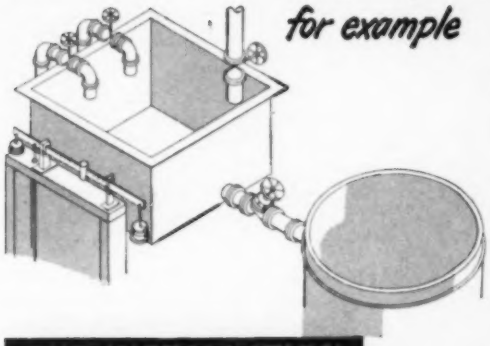
KOPPERS BITUMASTIC ENAMELS

KOPPERS COMPANY, INC., Tar Products Division, Dept. 861-T, Pittsburgh 19, Pa.

DISTRICT OFFICES: BOSTON, CHICAGO, LOS ANGELES, NEW YORK, PITTSBURGH, AND WOODWARD, ALA.

Found: This Good Alternate for Alloy Valves

on chrome tanning liquor, for example



THE INSTALLATION

At Gutmann & Co., tannery, Chicago, on outlet of open scale tank for mixing highly corrosive basic sulphate of chrome solution used in tanning.

THE HISTORY

This plant had more than its share of trouble with various valves and cocks tried in this service. The highly corrosive solution caused rapid seat wear, leakage, seizing, and constant stuffing box maintenance was necessary. The inoperative valves, and shut-downs for repairs played havoc with the daily schedule of solution mixing.

All this trouble has stopped since the plant installed a Crane No. 1615 Iron Body Packless Diaphragm valve with Neoprene diaphragm, disc insert, and body lining. Even after 2½ years in this severe service, the valve remains absolutely tight; shows no corrosive or erosive effects, no undue mechanical wear, and operates as smoothly as when new. Maintenance cost to date—zero.

VALVE SERVICE RATINGS

SUITABILITY:	Neoprene lining good
MAINTENANCE COST:	None - inspection only
CORROSION-RESISTANCE:	O.K. - no corrosion showing
SERVICE LIFE:	In 2½ years - still like new
OPERATING RESULTS:	No fluid loss - no valve trouble - no production loss
PRICE:	Lower than expected
AVAILABILITY:	Regular Crane item

THE VALVE

Crane No. 1615 Packless Diaphragm Valves with Neoprene Lining. Diaphragm acts as bonnet seal only; is not subject to rapid wear. Separate disc with Neoprene insert shuts off flow even should diaphragm fail. Neoprene body lining makes these valves highly suitable for many corrosive fluids, erosive sludges and slurries. Also available unlined. See your Crane Catalog or Crane Representative.

The Complete Crane Line Meets All Valve Needs. That's Why,
More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

Carlon Water Service Pipe

Now ... CARLON "WS" corrosionproof plastic pipe offers new advantages for municipal water system service connections. It is easier to handle, faster to install and lasts longer than any metallic pipe.

CARLON weighs only ⅛th as much as steel pipe — requires no rigging equipment. Being flexible, it can be curved to follow irregular contours or ditch lines. It is furnished in long lengths which require fewer fittings, and fitting make-up can be done in a matter of minutes. Special connecting fittings for corporation stops and meter yokes are available.

CARLON ends costly periodic replacement of water lines because of electrolytic corrosion or interior build-up. It is the only pipe that is guaranteed against rot, rust and electrolytic corrosion! Smooth internal wall will not accumulate scale or sediment — assures permanent free-flow.

Complete line of molded plastic fittings makes possible all-plastic installations and facilitates connection of CARLON "WS" pipe to previously installed metallic systems.

Nominal Pipe Size	O.D.	I.D.	Working Pressures P.S.I. @ 120°F.	Weight Per Foot	Normal Shipping Lengths
¾"	1.170	.824	120	.216	400' coils
1"	1.433	1.070	120	.285	300' "
1¼"	1.850	1.380	120	.477	300' "
1½"	2.260	1.610	120	.790	250' "
2"	3.000	2.070	120	1.88	200' "
2"	2.495	2.070	75	.620	200' "
2½"	2.950	2.470	75	.820	150' "
3"	3.670	3.070	75	1.280	100' "
4"	4.820	4.030	75	2.200	25' straight
6"	7.260	6.070	75	5.000	25' "

Write today for literature.

606-CP

CARLON PRODUCTS CORPORATION

In Canada: MICRO PLASTICS, Ltd., Acton, Ontario

10300 MEECH AVENUE • CLEVELAND 5, OHIO

Cleveland's Modern Sewage Disposal Plant

Is Equipped with

ROTOVALVES

by S. MORGAN SMITH COMPANY for Compressor Check Service

PROTECTING the motor driven centrifugal blowers, shown at the left, are 3—36" and 2—30" Air Check Rotovalves, at the EASTERLY SEWAGE WORKS pictured above, which are operated by pneumatic cylinders deriving air from the line at 7½ pounds pressure.

The selection of Rotovalves was made after searching analysis, and constitutes a tribute to their performance and dependability!

If in need of information covering similar operating problems and applications write us for details.

S. MORGAN
SMITH
COMPANY
YORK
PA.

MONO-CAST Pipe For Every Service Condition

"Mono-Cast" is the trade name for ACIPCO pipe cast centrifugally in sand-lined molds. Uniform metal section, high physical strength, endurance, and freedom from inclusions are salient properties which have established the name "Mono-Cast" as synonymous with highest quality cast iron pipe. It can be supplied with joints for conveying water, gas, oil, gasoline, sewage, salt brine, ashes—and in fact, just about everything that a pipe line can conceivably convey.

Being cast iron, Mono-Cast Pipe enjoys an enviable reputation. Cast iron pipe has had over three hundred years of service abroad and more than one hundred years of service in the United States. It is satisfactorily serving in locations where especially severe external and internal corrosion conditions exist. Mono-Cast Pipe is designed to give super-service, and its wide acceptance and splendid performance bespeak its excellence and the confidence and esteem in which it is held by those who are using it.

Since the beginning of our Company nearly half a century ago, ACIPCO has constantly worked hand in hand with engineers, contractors and superintendents in solving piping problems in their respective fields. Refer your next piping job to ACIPCO, and utilize the extensive manufacturing facilities of the largest individual cast iron pipe foundry in America. Let us assist you by taking off lists of material and submitting a price on pipe and fittings for your next job.

Write for free literature, stating the kind of joint in which you are interested. Address the ACIPCO office nearest you.

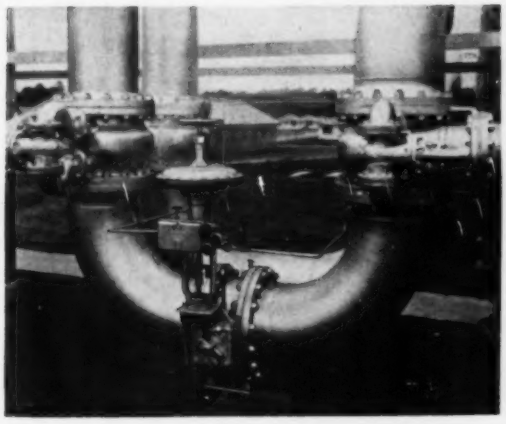
AMERICAN CAST IRON PIPE COMPANY

BIRMINGHAM 2, ALABAMA

Dallas	Houston	El Paso	Pittsburgh	Kansas City	New York City
Chicago	Minneapolis	Cleveland	Los Angeles	San Francisco	Seattle

R-S valvEvents

• EXCERPTS FROM THE R-S BOOK OF EXPERIENCE •



R-S Automatic Valve installed on water jacket to gas engine in gas booster station.

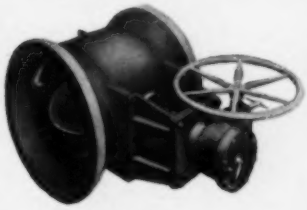
WIDE RANGE of Application

R-S Valves are used in air, gas, liquid, steam, and semi-solid service for the shut-off and regulation of volume and pressure, pressure relief, liquid level control, back pressure, water hammer, steam hammer, constant differential pressure, and the output control of pumps, fans, engines and turbines. Suitable for service in the temperature range from minus 300° to plus 2000° F. 2 to 2500 psig.

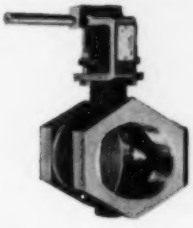
Simplicity of design, ease of operation, positive rubber seat shut-off, and the wide range of application indicate the high order of metallurgical and mechanical engineering that is embodied in every R-S valve.

Consult your local R-S Valve Engineers, or write direct.

R-S PRODUCTS CORPORATION
4600 Germantown Avenue, Philadelphia 44, Pa.
An S. Morgan Smith Company Subsidiary
DISTRICT OFFICES IN PRINCIPAL CITIES

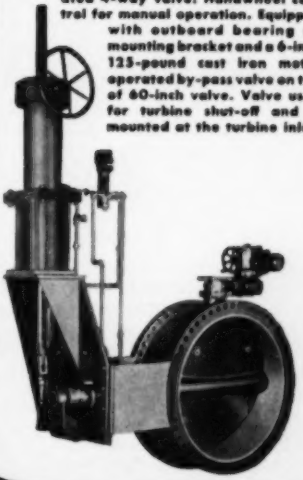


No. 836—24-inch 125-pound cast iron hub-end valve with bronze liner and monel periphery on vane for water service. Equipped with totally enclosed gear reducer, handwheel and locking device.



No. 801—3-inch 125-pound bronze screwed-end valve with handlever control and locking device.

No. 828—60-inch 150-pound cast steel valve with 18-8 shafts, bronze bushings and bronze body liner. Cylinder operator is controlled by electric motor operated 4-way valve. Handwheel control for manual operation. Equipped with outboard bearing on mounting bracket and a 6-inch 125-pound cast iron motor operated by-pass valve on top of 60-inch valve. Valve used for turbine shut-off and is mounted at the turbine inlet.



CLAY PIPE—*ESSENTIAL* ★ *ECONOMICAL* ★ *EVERLASTING*

More than 10,000 feet of Vitrified Clay Pipe are installed near Scranton, Pa., where Daystrom Instrument Division's new 350,000-square-foot plant will build Gunfire Control Systems for the U. S. Navy.

EYNON, PA., EXPANDS SEWERAGE
as Daystrom Builds Gunfire Control Plant

In peacetime, in preparation for defense, or in wartime — Vitrified Clay Pipe is the *dependable* material that serves America's expanding communities. It's the *only* readily available sewerage material that has proven its worth for municipal systems, housing projects, and industrial wastes through actual long-term performance in the ground.

Clay Pipe is safe because it's chemically inert — proof against the sewer gases and destructive chemical action that you've seen at work on so many non-clay materials. It stays round, firm, and smooth . . . protects the reputation of every man concerned with the job . . . because it always gives more service per dollar of investment. *It can't wear out!*

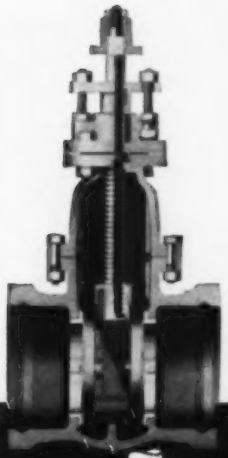
NATIONAL CLAY PIPE MANUFACTURERS, INC.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio
100 N. LaSalle St., Rm. 2100, Chicago 2, Ill.
703 Ninth & Hill Bldg., Los Angeles 15, Calif.
206 Connally Bldg., Atlanta 3, Ga.

WHEREVER RELIABLE, PERFORMANCE-PROVED PIPE IS NEEDED, SPECIFICATIONS CALL FOR VITRIFIED CLAY

Hartford, N. Y. (Electronic Plant Expansion)	50,000 ft.
Needles, Calif. (Essential Ore)	87,000 ft.
Marion, N. C. (Municipal Sewerage)	32,000 ft.
Orlando, Fla. (Air Force Base)	74,000 ft.
Willow Springs, Ill. (Jet Engine Plant Expansion)	16,000 ft.
Morrisville, Pa. (New Steel Defense Plant)	300,000 ft.
Tucson, Ariz. (Air Force Base)	440,000 ft.
Bakersfield, Calif. (Air Force Base)	196,000 ft.

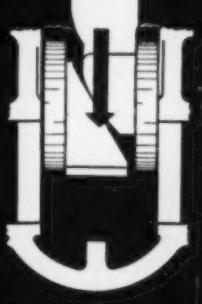
Vitrified
CLAY
CLAY PIPE NEVER WEARS OUT
PIPE

C-252-2

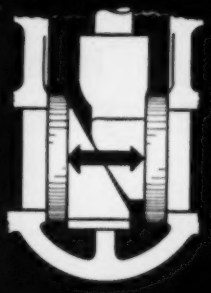


Look how you gain LONGER, TROUBLE-FREE VALVE LIFE

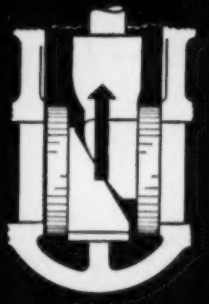
with Darling revolving disc gate valves*



DESCENDING. Fully revolving discs, independently hung, change seating position at each closing, assuring uniform wear distribution for prolonged service. Plain "no pocket" discs are interchangeable for *extra* life!



CLOSED. Faces of upper wedge are radiused and faces of both wedges are transversely beveled for equalized wedging pressure and *tight closing despite valve body distortion.*



RISING. Wedging pressure on both discs is released before discs start to rise. Complete absence of wedging pressure during travel of discs assures easy operation, tight closing and greatly prolonged valve life!

***DARLING REVOLVING DISC GATE VALVES FOR EVERY NEED.**

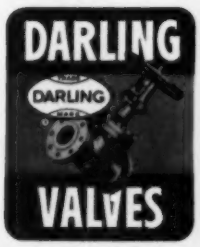
These unique Darling valves are available in a broad range of sizes and types, manually or motor operated, for all normal or unusual services. Before you invest in *any* valves, find out what you stand to gain by using the proper Darling valves on your job. Simply outline your service needs for specific data . . . or . . .

ASK FOR BULLETIN No. 5002

DARLING VALVE & MANUFACTURING CO.

Williamsport 11, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ontario



FOR PLUS VALUES, JOB-PROVED AGAIN AND AGAIN

This gallery in an Atlanta, Ga., filtration plant illustrates the complicated type of pipe layout that is so much more easily installed with Dresser Couplings than by other methods. This particular installation has been called *the most economical of its type ever built.*

"FLEXIBLE-TIGHT" JOINTS SIMPLIFY CONSTRUCTION

Around water, sewage and industrial waste installations, there is frequently a problem of precise fitting of very large, heavy pipe. Sanitary engineers have found that the *easiest* way to join this pipe is also the *most dependable.*

Any workman can install Dresser Couplings. No special skill is required. Installation moves right along and the need for close pipe fitting is eliminated.

Even when pipe ends don't meet, or pipe is slightly offset, Dressers permit safe, secure joining. The stress is taken up by specially compounded rubber gaskets that provide flexible, high-pressure packing around both pipe ends.

And all parts are factory built and tested . . . ready to install when you get them.

Dressers provide give-and-take, harmlessly absorb pipe movements from expansion and contraction, vibration and settling. And your joints stay tight for the life of your installation.

See your nearest Dresser Sales Engineer, or write today for more information about Dresser applications on water, sewage and industrial waste projects.

The complete dependability of Dresser Couplings is illustrated on this Dresser-Coupled sewage line in Wayne County, Michigan. Line runs under Rouge Parkway Lake that has been drained during construction. Despite soft pipe foundation, line had to be absolutely tight to prevent sewage contamination of the lake. And Dressers did the job.

DRESSER

"FLEXIBLE-TIGHT"

COUPLINGS

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston, Texas; 101 S. Bayshore Highway, South San Francisco, California. Sales Offices: New York, Philadelphia, Chicago, Houston, South San Francisco. In Canada: 629 Adelaide St., W., Toronto, Ont.

PITTSBURGH-DES MOINES

● *Manhattan Beach, Calif.* This Pittsburgh-Des Moines Radial Cone Bottom Tank has a capacity of 300,000 gallons, with tank diameter of 53'0", a head range of 20' 0", and height to bottom of 98' 6". The structure is designed and built to resist earthquake forces.

Elevated Steel Tanks

PROVIDING DEPENDABLE ELEVATED WATER STORAGE AT LOW COST—FOR EVERY COMMUNITY NEED

Pittsburgh-Des Moines Elevated Steel Tanks are available in a range of standard and special types covering the water storage requirements of municipalities of every size—in capacities from 5,000 to 3,000,000 gallons and more. Full information is furnished in our latest, illustrated brochure. Write for your copy!

PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH (25)	3418 Neville Island	DES MOINES (8)	919 Tuttle Street
NEWARK (2)	218 Industrial Office Bldg.	DALLAS (1)	1223 Praetorian Building
CHICAGO (3)	1222 First National Bank Bldg.	SEATTLE	526 Lane Street
LOS ANGELES (48)	6399 Wilshire Blvd.	SANTA CLARA, CAL.	625 Alviso Road

FORT WORTH INSTALLS 6 PROCESS CLARIFIERS!

General view of Fort Worth, Texas Sewage Treatment Plant. Consulting Engineers for the recent additions, Freese & Nichols. Contractor, Russ Mitchell, Inc. Plant operation under the direction of W. S. Mahlie, Sup't Water and Sewage Treatment.

Close view of one of the final clarifiers with a side feed influent arrangement.

The progressive city of Fort Worth, Texas, known for its contributions to the art and science of water and sewage treatment, has again made additions to the sewage treatment plant. These new facilities include six 95' dia. Type C Process Clarifiers. Three of these are for sedimentation in the intermediate treatment step and three of the mechanisms are for the final sedimentation units.

If in need of clarifier mechanisms, investigate the modern, built-to-last and trouble-free Process Clarifier. Write to any address listed below for complete information.

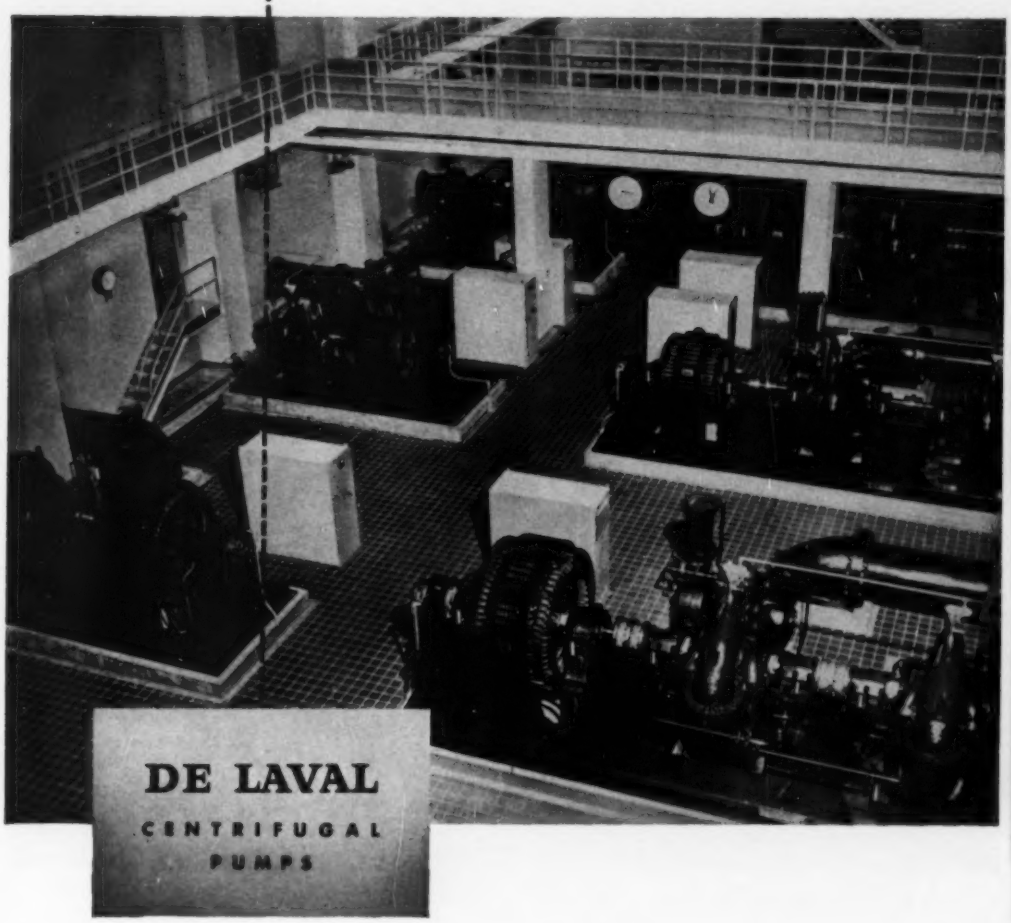
PROCESS ENGINEERS INCORPORATED

312 SUTTER STREET
SAN FRANCISCO 8, CALIF.

6381 HOLLYWOOD BLVD.
LOS ANGELES 28, CALIF.

EASTERN AND MIDDLE WESTERN REPRESENTATIVE:
PACIFIC FLUSH-TANK COMPANY · 4241 RAVENSWOOD AVE., CHICAGO 13, ILL.

Delivering 172 mgd more for Cleveland



These new De Laval centrifugal pumps in the Nottingham filtration plant help deliver an additional 172,000,000 gallons of filtered water daily to Cleveland's growing population. Today 80% of America's largest cities depend upon efficient De Laval centrifugal pumps. They are available in capacities ranging from less than one million gallons per day to more than 100 million gallons per day.

DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY
Trenton 2, New Jersey

SL-189

2100-TPA-2114

Light Sleeper...

How quickly do you wake up?

In case normal line power should fail at Northwestern Bell Telephone Company in Minneapolis, the sensitive standby power plant above pops awake in seconds, starts delivering critical emergency power.

This ever-alert protection is supplied by an E-M, 1250 KVA, 720 rpm Synchronous Generator driven by a diesel engine. A system of relays starts the unit instantly if line power is interrupted . . . all the calls from Northwestern Bell's 93,000 downtown telephones can then be carried on by standby power.

You'll find hundreds of other E-M Standby Generators ready for action in exacting emergency situations all over the world. Each E-M Generator has been individually tailored to specific requirements. These accomplishments have made E-M engineers specialists in solving original design problems.

If you have no emergency protection, or feel your present equipment may be inadequate, ask your nearest E-M sales engineer for his suggestions. Also, write for Issue No. 35 of the E-M *Synchronizer*, illustrating the full line of E-M Generators. It has a special section on emergency power.

ELECTRIC MACHINERY MFG. CO.
MINNEAPOLIS 13, MINNESOTA

A complete line of AC generators for standby sets

Woo ooosh!

Here's the secret.
This impeller has no blades to catch and hold trash.

. . . and NO clogging!

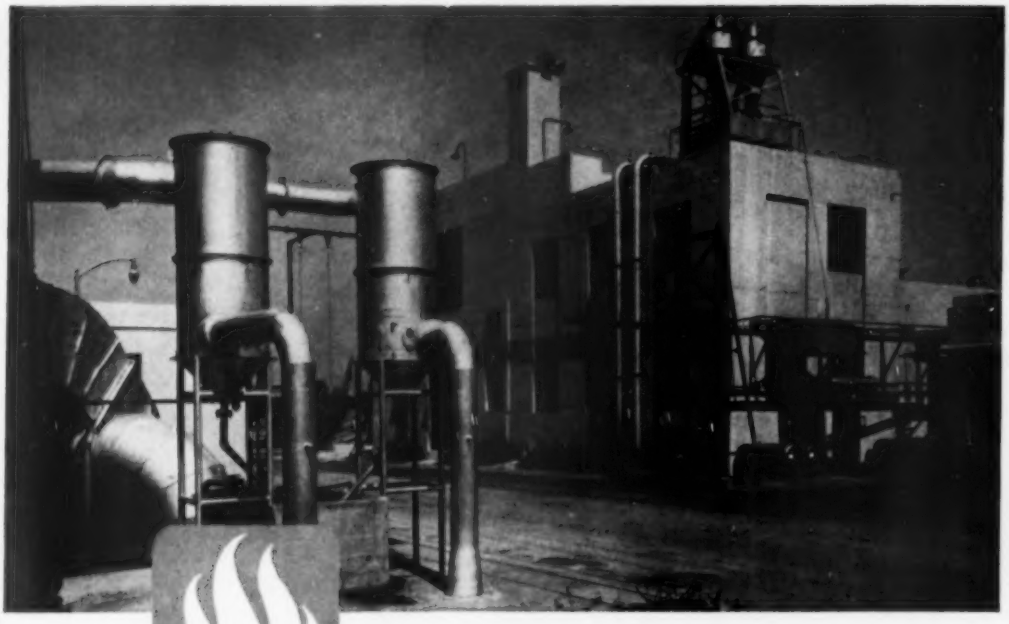
Yes, fibrous material follows this path through a Fairbanks-Morse *Bladeless* Impeller Pump . . . just a "whoosh" and it's through without clogging. The secret to this truly non-clog pump is in the *bladeless* impeller—there are no blades or projections in this "whirling tube" to catch and hold trash . . . you really cut maintenance!

This Fairbanks-Morse pump has been thoroughly tested—even a man's complete coveralls went through a 4-inch pump without clogging! So check your Fairbanks-Morse Pump Distributor or Local Branch Office for the complete story on this *Bladeless* Impeller Pump . . . or write to Fairbanks, Morse & Co., Chicago 5, Illinois.

FAIRBANKS-MORSE

a name worth remembering when you want the best

PUMPS • DIESEL LOCOMOTIVES • ELECTRICAL MACHINERY • SCALES • HOME WATER SERVICE EQUIPMENT • RAIL CARS • FARM MACHINERY • MAGNETOS



New C-E Flash Drying Unit at San Diego Extension

...almost triples capacity of original installation

When San Diego's Sewage Treatment Plant went into operation in 1943 it was equipped with a C-E Raymond Flash Dryer Unit designed to handle 63 tons of filter cake per day. Shortly after the war plans were made to increase the capacity of the plant to meet the growing needs of the San Diego area.

In June of 1950 the San Diego Extension went into operation, serving an equivalent population of more than 500,000. The C-E Flash Dryer Unit at this extension handles almost double the amount of filter cake as the original unit — 110 tons per day. The evaporation rate of the second unit is about 5000 pounds per hour.

San Diego Extension, as well as the original installation, is typical of C-E Raymond System installations, now in service in virtually all parts of the country, meeting the varying requirements of both large and small communities. They are flexible in layout, highly efficient and thoroughly reliable; they provide for maximum utilization of waste heat.

The services of C-E specialists are available to assist you in finding the best solution to your sludge problem. Get in touch with the office nearest to you for prompt attention. B-525

Representative list of C-E Raymond installations since 1945

BALTIMORE, Md.	SAN FRANCISCO, Calif.
BETHLEHEM, Penna.	SCHENECTADY, N. Y.
BLOOMSBURG, Penna.	SHEBOYGAN, Wis.
CAMDEN, N. J.	WASHINGTON, D. C.
CHICAGO, Ill. (W. Southwest)	WATERBURY, Conn.
FOND DU LAC, Wis.	WYOMISSING VALLEY, Penna.
HOUSTON, Texas	COLNE VALLEY, England
LANSING, Michigan	RECIFE, Brazil
LOS ANGELES, Calif.	

SAN DIEGO, Calif. (Extension)

COMBUSTION ENGINEERING—SUPERHEATER, INC.

1315 North Branch Street **FLASH DRYER DIVISION** Chicago 22, Illinois

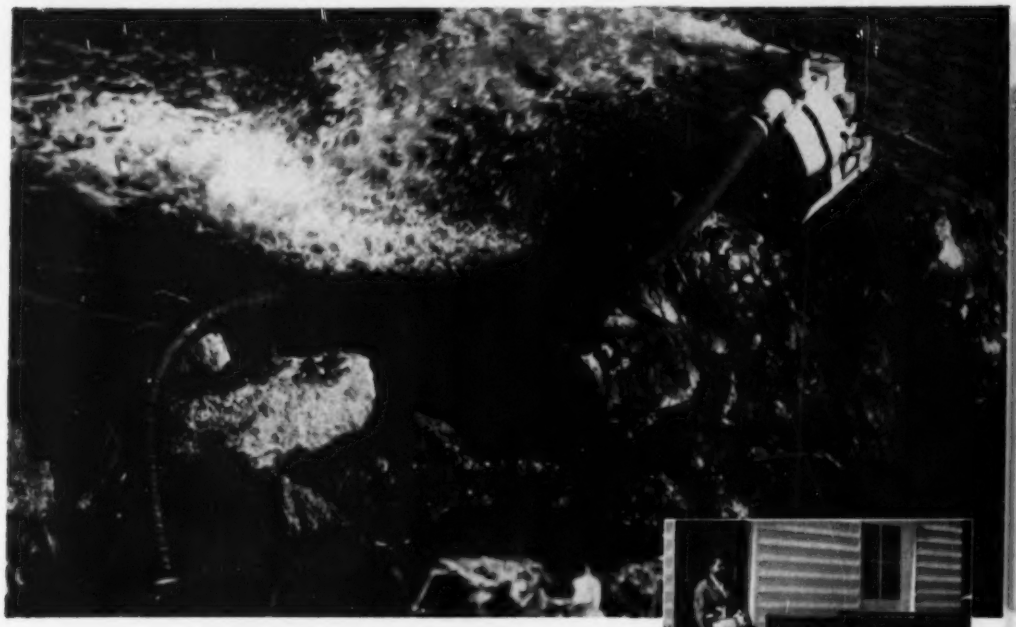
Western Office: 560 W. Sixth, Los Angeles 14, Calif. Eastern Office: 200 Madison Ave., N. Y. 16, N. Y.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT

ACTION!

When You Need It — Where You Need It

HOMELITE *CARRYABLE* PUMPS



The same thing happens every spring. Thaws and floods move into the scene... and when they do you want action, *fast pumping action.*

No pump will give you quicker action or better action than a Homelite Gasoline Engine Driven Pump. Small and compact, it presents no transportation troubles. One man can carry it and set it up quickly *any place you need it.* With the fastest automatic self-priming, a Homelite pumps up to 15,000 gallons. It keeps seepage at strainer level automatically. Has a guaranteed 28 foot suction lift . . . is non-clogging and completely weatherproof.

See it in action...on your job. Write for a free demonstration.

Homelite Field Service
When you need it — Where you need it
All over the country, Homelite Factory Branches are ready, willing and equipped to give prompt service in their shops or in the field as you need it.

Manufacturers of Homelite
Carryable Pumps • Generators
Blowers • Chain Saws

PERFORMANCE • DEPENDABILITY • SERVICE

HOMELITE
CORPORATION
708 RIVERDALE AVENUE • PORT CHESTER, N. Y.

Expanding Ft. Worth ADOPTS P.F.T. MODERN CONTROLLED DIGESTION

Back in 1922, Fort Worth, Texas, built its first major sewage treatment plant. It incorporated Imhoff tanks and a filter bed with 342 P.F.T. Fixed Nozzles, with a 30" P.F.T. Dosing Siphon.

In 1928, the first major change converted the Imhoff tanks to rectangular clarifiers and added three more filter beds with 342 P.F.T. Fixed Nozzles per bed. The addition, at this time, of eight 30" P.F.T. Twin Tank Siphons and 16 P.F.T. Automatic Feeds, provided improved control for uniformly dosing the three new filters and the existing filter. P.F.T. Fixed Nozzle Filter Beds cover an area of 8 acres at this modernized plant.

The most recent additions — 1945 and again in 1950 — each included P.F.T. Controlled Digestion with two P.F.T. 75' Floating Cover Digesters, and P.F.T. Gas Safety Equipment. Two of the digesters are equipped with P.F.T. Supernatant Selectors and accessory Sight Gauges and Samplers. Fort Worth is one of the many progressive Texas cities safeguarding public health and investment with P.F.T. Equipment.

Freese & Nichols, Fort Worth, have handled the various phases of this work.

P.F.T. PACIFIC FLUSH TANK CO.

Waste Treatment Equipment Exclusively Since 1893

4241 RAVENSWOOD AVE. CHICAGO 13, ILLINOIS

NEW YORK • LOS ANGELES • SAN FRANCISCO • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

TEST PUMPING

tells an interesting story

The outstanding features of Layne constructed wells and pumps are pictured and described in a catalog entitled "Layne Well Water Systems." A copy will be sent on request.

"Test Pumping"—is the trial run, shake-down cruise—or field maneuver of every well constructed by Layne. It is these tests that show what skill and experience have accomplished.

But long before the test pumping can be made, Layne has had to do a lot of planning, plotting and figuring out of such things as; kind of sand screen, size of drive shaft, type of bearings, number of pump stages and how much horsepower the motors should have to produce a promised amount of water against a certain pressure.

Once all of the above answers are on paper, they must be transmitted into an underground construction project—a task that requires more than ordinary skill and ability.

But wherever water is needed in quantity and at low cost, you may be sure that units installed by Layne will have unmatched efficiency, operate with utmost smoothness, be ever dependable and capable of lasting many, many years.

For further information on any phase of water development, address

LAYNE & BOWLER, INC.
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Layne
WATER WELLS
VERTICAL TURBINE PUMPS
WATER TREATMENT

Combined for Service and Savings:

AUTOMATIC CONTROL

and INSTRUMENTATION

by HAGAN

Hagan Engineers have developed automatic control equipment and instruments which can be assembled into coordinated systems designed to meet your particular requirements. For example:

HAGAN AIR-OPERATED AUTOMATIC CONTROL EQUIPMENT includes pressure measuring and control units which may be combined into automatic control systems for process industries, metallurgical furnaces and steam power plants.

HAGAN THRUSTORQ is designed to measure forces and transmit a proportional signal to actuate a recording or indicating instrument, or an automatic control system. Typical applications include: automatic batch weighing, rocket thrust measurement, dynamometer testing of electric motors and internal combustion engines.

HAGAN RING BALANCE FLOW METERS are the most versatile meters available. Hagan Meters indicate, record, and integrate one or two flow rates. Standard modifications provide for pressure and temperature compensation. Ring assemblies are available to measure pressure differentials from 20" to 140" WC at static pressures up to 15,000 psig, and from 40" to 420" WC at static pressures to 2000 psig.

WRITE, WIRE or PHONE today for information about how Hagan Engineers can help you solve your industrial control and instrumentation problems.

HAGAN CORPORATION

HAGAN BUILDING
PITTSBURGH 30, PENNSYLVANIA

RING BALANCE FLOW AND PRESSURE INSTRUMENTS
THRUSTORQ FORCE MEASURING DEVICES
BOILER COMBUSTION CONTROL SYSTEMS
METALLURGICAL FURNACE CONTROL SYSTEMS

HAGAN
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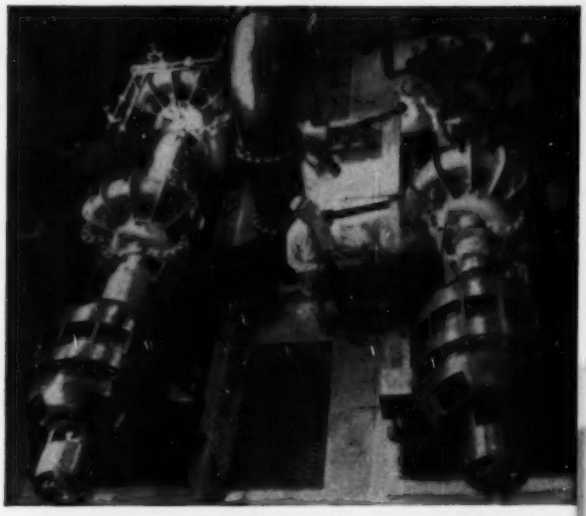
Worthington Serves Fort Worth Pumping Station Since 1893



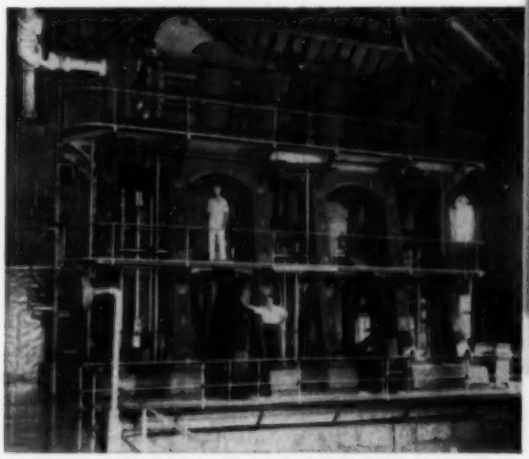
WITH NEARLY TWICE THE CAPACITY of the old triple-expansion engines formerly used, these two Worthington centrifugal pumping units can move as much as 30,000,000 gallons of water per day. Between the pumps, stands Fort Worth's Holly Pumping Station plant superintendent, Fred King, an enthusiastic Worthington backer.

Texas city again turns to Worthington for dependable pumping

After 50 years' experience with two triple-expansion Holly pumping units, the city of Fort Worth, Texas, didn't have to think twice before they installed two Worthington 15 mgd centrifugal pumping units to increase the capacity of their Holly Pumping Station.

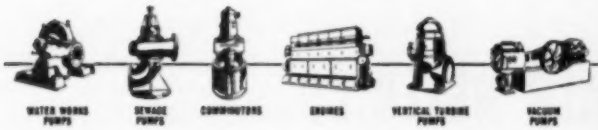
Each new unit consists of two pumps in series. Since the new installation was made, the old Holly unit has been maintained for stand-by service. Soon, this old Holly veteran will be replaced by 2 more Worthington centrifugal pumping units with a capacity of 27 mgd, bringing the total volume of water handled by Worthington pumps to 84 mgd.

The Fort Worth story is just another example of the kind of service many cities, large and small, are getting from Worthington equipment and engineering. All will testify that *there's more worth in Worthington*. Worthington Corporation, Public Works Division, Harrison, N. J.



INSTALLED IN 1893 AND STILL OPERATING, this giant Holly Pumping Engine has a rated capacity of 8,000,000 gallons per day, a pumping head of 285 ft. One of two such units, it is now used for stand-by service at the Fort Worth pumping station, but it will soon be replaced by two 27-mgd Worthington centrifugal units.

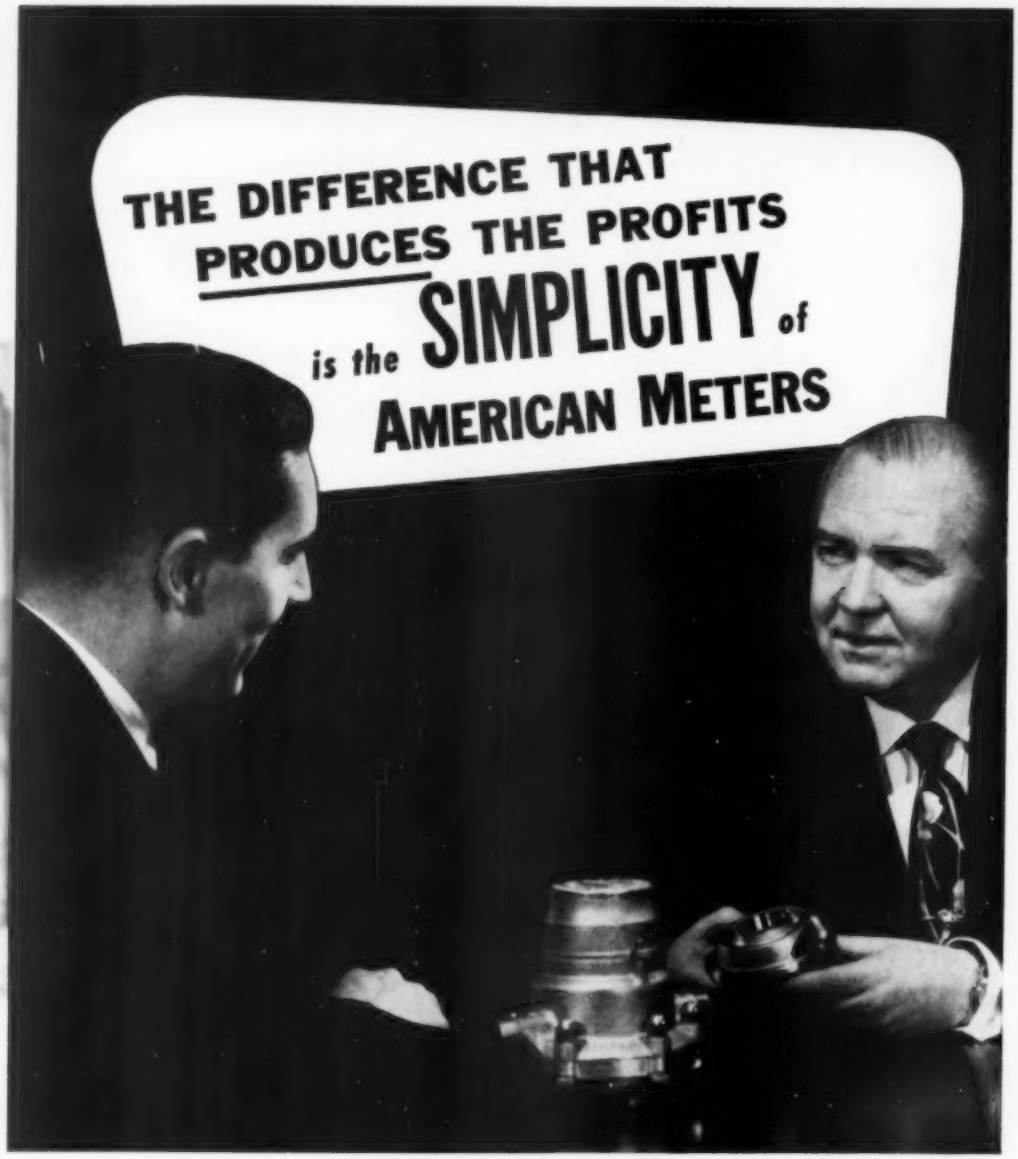
W.1.6



All Major Public Works Equipment Under One Responsibility

WORTHINGTON

Public Works Equipment



● Most makes of Water Meters look similar, are made of the same materials, are priced competitively and are claimed to provide the same accuracy. What, then, are the differences? What values are outstanding?

American Meters stand out as the most exceptional value because of simplicity of design—fewer parts, simpler castings. This simplicity provides long life, quick easy repair. Only a small stock of interchangeable parts are needed to keep these meters producing. These benefits mean low cost efficient operation of the water department.

Ask for complete data.

BUFFALO METER CO.

2909 MAIN STREET, BUFFALO 14, NEW YORK

The SPEED You Need

BUCYRUS ERIE

HYDROHOE

To Get There Quick

This fast-stepping, all-hydraulic Bucyrus-Erie Hydrohoe moves in traffic as easily as your automobile — zips along open highway at speeds up to 50 mph — sets up in three to four minutes — and is ready to take off in equally short order after the job is finished.

Telescoping boom is fully retracted and fits snugly over cab on a strong brace when in travel position. There's no unwieldy extension sticking out to slow down the Hydrohoe. Notice the machine's low super-structure — this speedster slips right through underpasses as low as 12 ft.

With such speed and agility in traffic, the Hydrohoe can handle a number of trenching jobs at widely separated locations — in a single day. In addition, the superior maneuverability makes it the natural choice for close quarter digging.

Speed is only one of many Hydrohoe advantages. It's quickly convertible to crane front-end in the field for setting pipe, hoisting plumbing fixtures to upper stories, moving supplies, etc. Send coupon for full details.

173H52

Here is the Hydrohoe in action. Every work function fully hydraulic. Available with 18- or 12-inch dipper. The only dragshovel with two separate digging actions! The first is the conventional dragshovel digging arc. The second — a leveling and smoothing stroke — is obtained by telescoping the boom.

BUCYRUS-ERIE HYDROCRANE DIV.
South Milwaukee, Wisconsin

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South Milwaukee
Wisconsin

☐ Please send Hydrohoe literature.
☐ I am interested in a demonstration.

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Company.....
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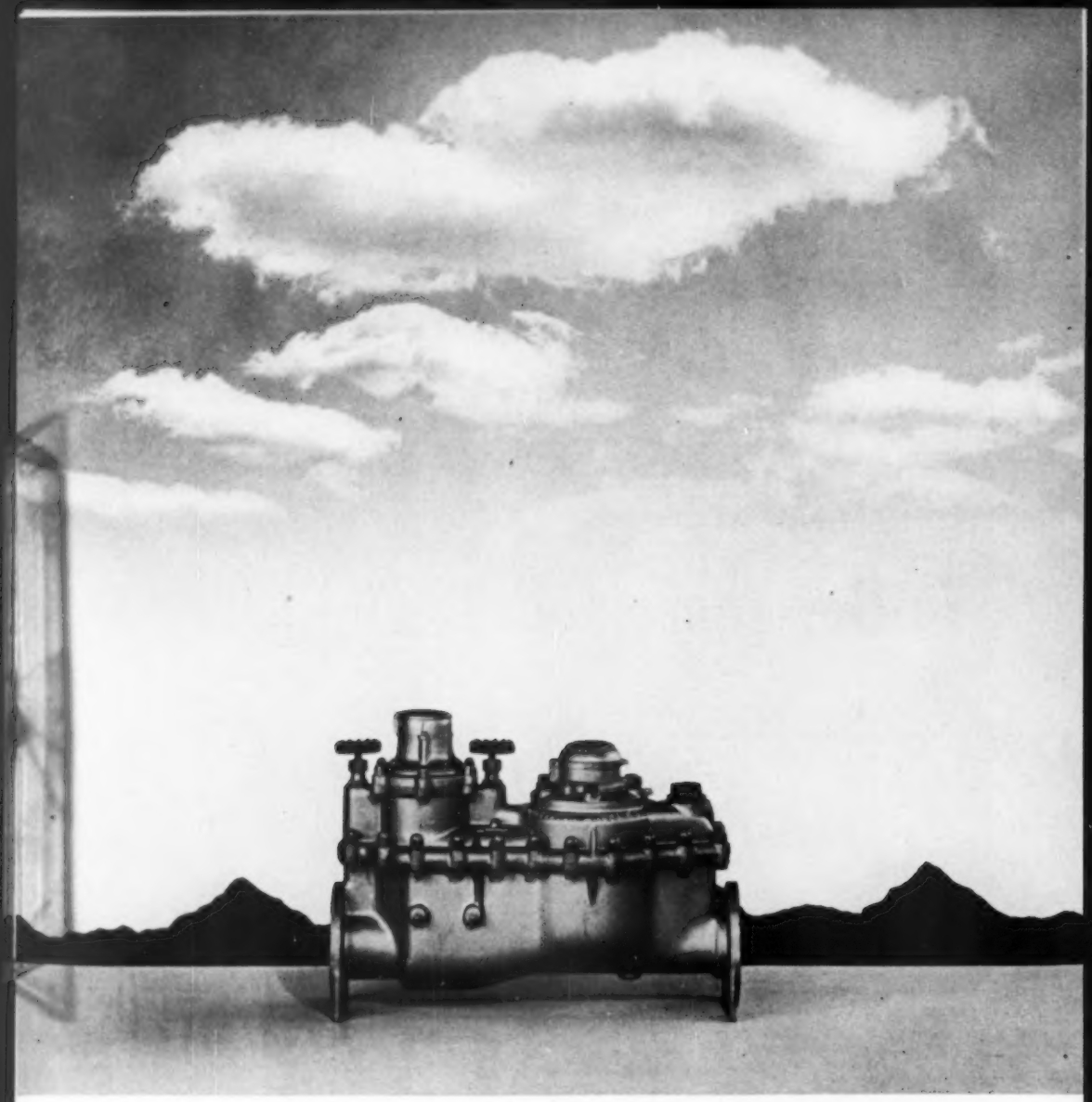

Its national acceptance by experienced Water Works officials proves conclusively that there is no substitute for the

COMPOUND METER

AS MADE BY HERSEY

HERSEY MANUFACTURING COMPANY

SOUTH BOSTON, MASS.

BRANCH OFFICES: NEW YORK — PORTLAND, ORE. — PHILADELPHIA — ATLANTA — DALLAS — CHICAGO
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30% LESS SLUDGE...

Sludge Bed Dries in Weeks Instead of Months ...with ENZYMATIC Treatment!

Drying bed of the Oakland, Missouri Disposal Plant, where Enzymatic boosted drying time to an "unbelievably rapid rate". City officials say, "Enzymatic is the most remarkable product we have ever tested . . . economically solves every problem our disposal system faced."

Drying Time Before:
14 WEEKS!

Drying Time With
ENZYMATIC:
14 DAYS!

Communities Report Astounding Results with New ENZYMATIC Product in Sewage Treatment Plants.

ENZYMATIC IS PERFORMANCE GUARANTEED!

- Completely eliminates or greatly reduces odors
- Reduces amount of sludge at least 30%
- Increases gas production—keeps it steady
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- Cleans spray nozzles—keeps them open
- Eliminates need for standby heating and fuel purchases
- Speeds sludge drying—to weeks instead of months
- Prevents "flop-over" and "sloughing off"

MAKE YOUR OWN TEST OF ENZYMATIC. Prove to your own satisfaction as hundreds of cities have done. Enzymatic is sold on a *performance guarantee.*

N. O. NELSON
Company
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SEND COUPON FOR COMPLETE TECHNICAL INFORMATION!

To: N. O. Nelson Co., P. O. Box 3265, Dept. F. St. Louis 10, Mo.

Gentlemen: Please send me full details on Enzymatic.

Name.....

Company.....

Position.....

Address.....City.....Zone.....State.....

Water Well Cleaning with Calgon* gets results like this:

WELL #1	**from 300 gpm to 600 gpm**
WELL #2	**from 300 gpm to 600 gpm**

Capacities of these two wells were doubled for an Ohio City when the cleaning job was done with • • • . . . Calgon

Because Calgon is not toxic, there is no danger involved in cleaning wells with • • • • • • • . . . Calgon

Our engineers will be glad to show you how Calgon can increase the productivity of your water wells. Write, wire or phone for information.

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2ND Accelator®

satisfies increased needs ...at North Miami

WILLIAM SYDOW, *Consulting Engineer, Miami, Florida*

The ACCELATORS and Infilco auxiliary equipment in the modern water treatment plant at North Miami — new ACCELATOR is at the left in plant photo below.

Highly pleased with the performance and results obtained with their first ACCELATOR, the city of North Miami has recently set in operation their second ACCELATOR.

Infilco's Service Engineer... on the job at North Miami... reported: "The original ACCELATOR has been operating with excellent results at almost twice rated capacity while installation of the new one was underway."

Ability to handle overload is but one of the ACCELATOR'S many factors of satisfaction to city and industry management. Naturally, the ACCELATOR saves you valuable space... three operations are combined in one basin. But most important, the Accelator increases throughput because of its dynamic separation principle of operation... plus providing the advantages of lower operating costs, far less maintenance and supervision than with "old-style" treatment plants.

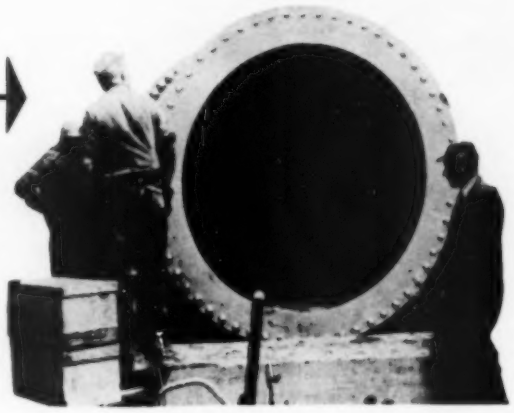
For complete information, write for Bulletin 1825. Or telephone your nearby Infilco Field Engineer.

INFILCO since 1894

INFILCO INC. *Tucson, Arizona* | *Plants in Chicago & Joliet, Illinois*

FIELD ENGINEERING OFFICES IN 26 PRINCIPAL CITIES

WARREN
is the name
for everything you want in cast iron pipe!



Durable, long-lasting . . . made with the proper crushing, beam, shock and bursting properties for maximum strength. Desirable qualities in any pipe, you'd say?

Warren Cast Iron Pipe stays in service . . . its lasting qualities have been proved by excavated pipe that has been underground for 93 years . . . and *still* in good condition! Made in all sizes from 2" to 84" with all types of joints. Special castings in medium to heavy weights in many non-standard patterns to help you solve those problems that require "different" installations.

Also available in gray iron and Meehanite iron.

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Bell & Spigot Pipe • Flange Pipe • Mechanical Joint Pipe
Flexible Joint Pipe • Short Body Bell & Spigot Specials

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96 Years of Continuous Service

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CAST IRON PIPE...
AND BE SURE!

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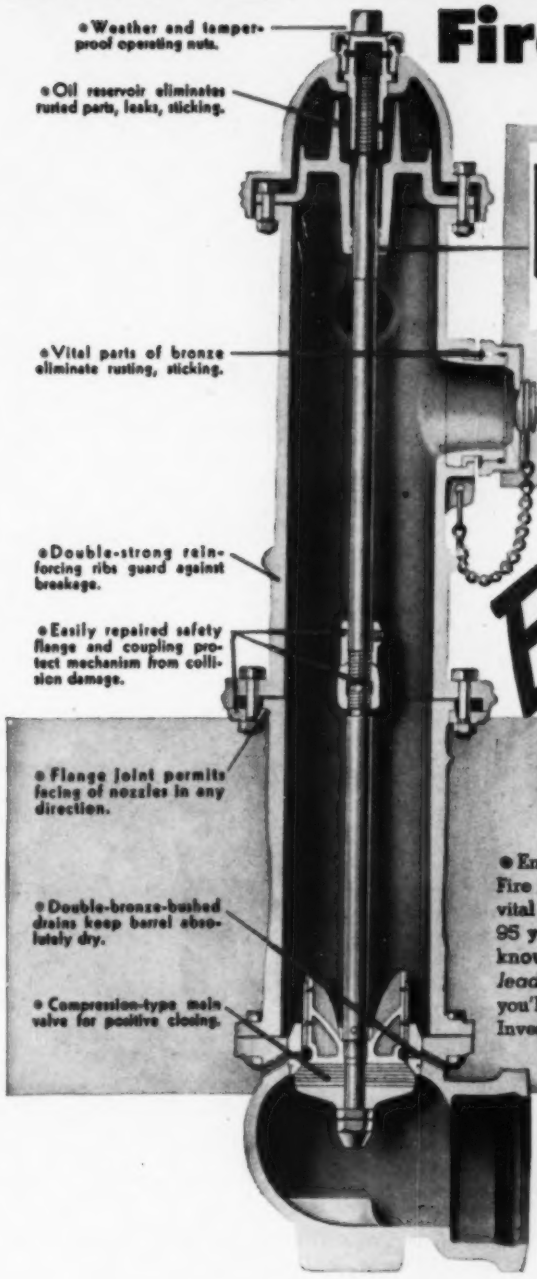

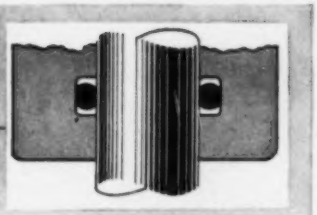

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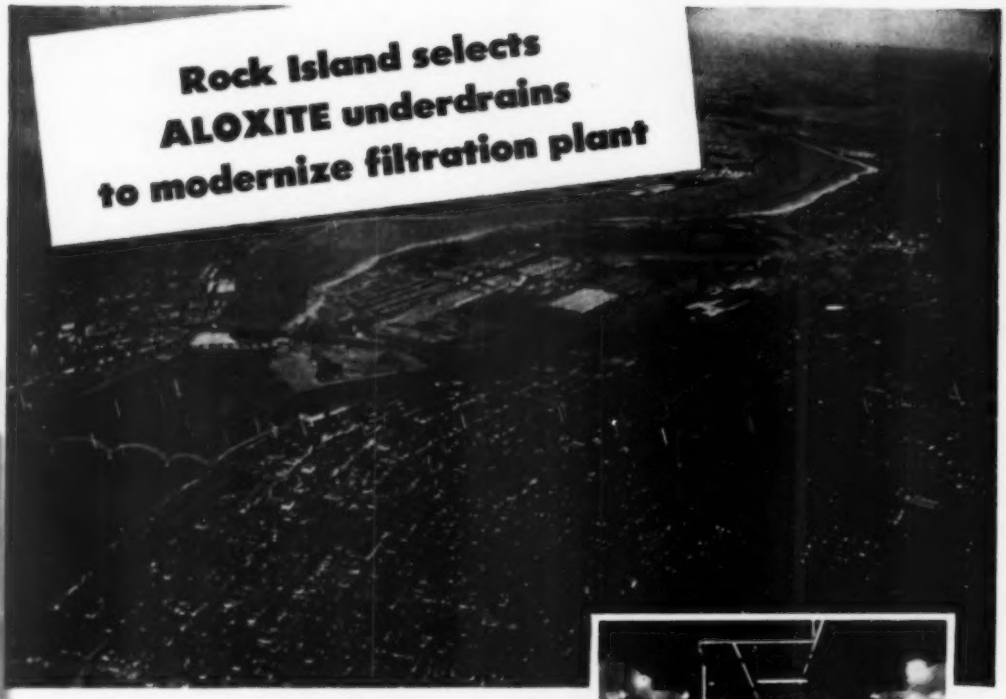

Information courtesy Rock Island Dept. of Public Works

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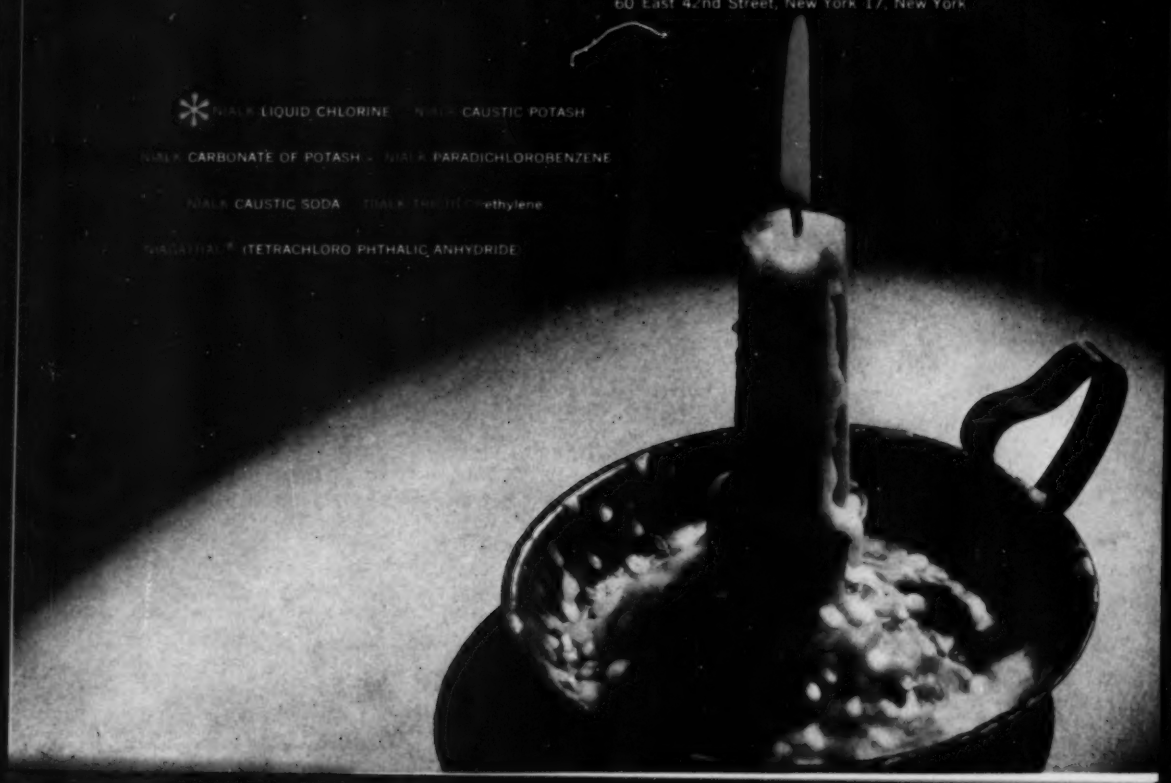

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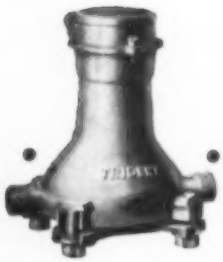

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WATER & SEWAGE WORKS

VOL. 99, NO. 8 • A GILLETTE PUBLICATION • AUGUST 1952

1952 Annual Roundup of A.W.W.A.

Technical Sessions at Kansas City—II

THIS installment is our third and concluding report of the 72nd Annual Conference of the A.W.W.A. in Kansas City, May 4-9, 1952. The June issue of *Water & Sewage Works* described the highlights and social affairs of the meeting, and the July issue carried the first report of technical sessions. Digests of additional papers and session meetings are included in this installment.

Several new techniques presented in one purification division session proved of much interest. Three papers discussed, respectively, the membrane filter for water analyses, flotation as a potential purification process, and the feeding of activated carbon by a slurry method.

The Membrane Filter as a New Tool

APPLICATION OF MOLECULAR FILTER MEMBRANES TO SPECIFIC PROBLEMS IN WATER ANALYSES was the title of a paper prepared by Alexander Goetz, Assoc. Prof. of Physics, Calif. Inst. of Tech., Pasadena, Calif.; R. H. Gilman, Asst. Supt., and A. M. Rawn, Chief Engr. and Gen'l. Mgr., Los Angeles County Sanitation Districts.

Tracing the development of membrane filters from the simple collodion sheet, Dr. Goetz, who presented the paper, said it is now possible to produce a cellulose ester molecular screen of uniform 2-3 micron size. A 1.5 liter sample of water can be filtered through this screen in less than one minute. Through capillary action, the bacteria retained on top of the screen may obtain food from culture media to which the screen is transferred; the screen may be transferred to differential media. Thus, amazingly rapid growth of bacteria can be accomplished.

Lantern slides were shown to illustrate the membrane filter equipment (very similar to the Gooch suction filter flask) and the growth of colonies on membranes. A maximum of about 500 colonies may be counted on a membrane as compared with 250 on an agar plate. The filter method is obviously applicable only to relatively clear water—heavy turbidity particles create a serious problem. Comparative studies show substantially higher counts result from the membrane filter technique as compared with the usual plate method.

MR. GILMAN described a recent evaluation of the membrane filter and Gooch filter equipment for turbidity measurement. Suspended matter recovery was considerably better by use of the membrane method when turbidities were low; the same recovery of suspended matter was indicated by each method at and above 800 ppm. turbidity.

In discussion of the paper, B. C. NESIN (Dir. of Labs., New York City) admitted great potentialities for this new tool, but termed it a "watchmaker's" technique which requires

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Washington, D.C.

Programmers

new training. The cost of membranes (16 cents each) is relatively high.

H. O. HARTUNG (Prodn. Dept. Engr., St. Louis County Water Co.) raised a question concerning the difficulty of transporting large volumes—one to two liters—of finished water samples from the field to the laboratory. It was explained that the filtration of large volumes is not necessary if 100 ml. samples provide the information required.

W. W. DEBERARD (City Engr., Chicago) cited the steady progress made in the development of improved methods which have reduced the time required for coliform organisms from 72 hours down to 16 hours.

Float Dirt Out!

A FLOTATION PROCESS FOR WATER PURIFICATION was described by Samuel H. Hopper, Assoc., Prof. of Public Health, Indiana Univ., Indianapolis.

The principle involved in this process is borrowed from the mining industry; it involves selective coating of particles to make them hydrophobic and to float them to the surface. An article describing potential application of the process was published in the A.W.W.A. Journal in 1945.

This treatment is particularly intended to remove colloidal and finely suspended materials. A dose of 10 to 12 ppm. of chemical (the cationic type of detergent only, in order to reduce foam formation) is generally required.

Lantern slides illustrated removal of bacteria, cysts, and suspended material, using electron microscope photographs. The method is advocated for emergency treatment of water. The chemical cost would be $40 per mg. (using a 10 ppm. dose of chemical costing $4.00 per lb.). A demonstration of the procedure by Prof. Hopper aroused considerable interest. It was suggested that the technique might be especially applicable to industrial waste treatment.

Carbon Feed at Chicago

SLURRY FEEDING OF ACTIVATED CARBON was the subject of a paper presented by John R. Baylis, Engr. of Water Purif., Bureau of Eng., Chicago, Ill.

When the Chicago plant was placed in operation powdered activated carbon was fed by means of 9 hoppers and 9 dry feed machines. The design rate of the feeders could not be attained because of dust and difficult working conditions; daily average was 274 bags, one day maximum was 2,423 bags, and considerable labor was required to burn the bags.

First slurry feeding units were placed in operation in 1948. Carbon is discharged directly from hopper type railroad cars to round steel storage tanks. The tanks are provided with horizontal stirring equipment and recirculating pumps. Wetting the carbon is by agitation (a tank contains a 6′ to 8′ depth of water when carbon is dumped). Generally one-half car load is discharged daily and 2 to 5 days is required for wetting. Entrapped air appears to make the wetting difficult.

The slurry is quite corrosive, and a "Mono" pump moving 6 gal. per min. has proven successful for delivery of slurry to the feeding device where the flow is split to three points of application. Future improvements will probably include separate high speed agitation for wetting the carbon and separate slurry storage tanks.

W. W. AULTMAN (Asst. Dir., Dept. Water & Sewers, Miami) reviewed the first use of slurry feeding in 1941 at the Metropolitan plant in Southern California. The corrosion problem is severe indeed. Wetting carbon from the top has been found most effective.

[The following reports were prepared by L. L. Hedgepeth, Tech. Consultant, Amer. Cyanamid Co., Bound Brook, N.J.]

New Ideas in Filter Design

AN IMPROVED DESIGN FOR RAPID SAND FILTERS was described by Thomas M. Riddick, Cons. Engr., and Chemist, New York, N.Y.

Mr. Riddick's paper was essentially a plea for reducing plant costs by the application of new knowledge of filter media behavior, and by the simplification of filter construction. It was supported by data from his studies and by construction costs and operating data from two of his industrial water processing plants.

Experiences at the Ossining, N.Y., plant caused him to believe that prechlorination could be used for color reduction and iron and manganese removal in a well designed and operated filter. Accordingly, he designed and placed into operation in 1948 a small plant at a paper mill at Newville, Penna., employing only chlorination and filtration. The results have been excellent and have shown that coagulation and sedimentation are not needed at that plant. Further studies there and at Ossining indicated that the iron would first deposit upon the sand as a hard coating, but that this hard deposition ceased after awhile and that later iron removal was in the form of flocculent ferric hydroxide, which was readily removed during the filter back washing. Further, that 98 per cent of the iron deposition occurred as flocculent deposit throughout the entire filter bed.

A 4.5 mgd. filter plant employing these principles has been designed and built by him at Oswego, N.Y., for a paper mill. Initial operation this year affirms the correctness of this treatment principle. The color of the raw Lake Ontario water is being reduced from 20 ppm. to 0-5 ppm., the turbidity from 15-5 ppm. to 0-5 ppm., and the iron from 0.2-0.3 ppm. in the raw water to 0.005 ppm.-nil in the finished water. High turbidities of the raw water have been handled by injection of 50 ppm. alum in six treatments of eight minutes each during each filter run.

Important novel features of this plant are simplified controls, new type filter bottoms and wash troughs, and filter sand selected with consideration for its surface texture in addition to the usual filter sand quality considerations.

The conventional Venturi rate controllers have been replaced by butterfly valves connected with influent floats, the influent valves have been made unnecessary through arrangement of influent piping, the wash water troughs consist of Class 100 Transite pipe with 90° cutouts, the filter bottoms are constructed of an ingenuous new arrangement of perforated Transite plates and strips.

Mr. Riddick then told of his studies on the effects of the surface texture of sand on filter performance. Use of the new wide field stereoscopic microscope for examination of filter sands revealed a range of surface conditions of sands which have substantially the same physical characteristics by other methods of measurement.

In discussion, E. A. SCHMITT asked about the turbidity of the raw water vs. the applied water and Mr. Riddick replied that, since there was no coagulation and sedimentation the turbidities were the same but that the filtrate was virtually free of turbidity.

D. M. WILLIAMS, expressed surprise at the use of Transite in the filters since the Canadian agents for this material had told him it was unsuitable. Mr. Riddick replied that they showed no interest in his work and that "They will wear you out before they will help you on this."

L. H. ENSLOW inquired as to details of the alum injection into the filter influent and Mr. Riddick explained the makeshift arrangement used which, nevertheless, provides a practical system of coagulant feed.

Norman J. Howard
Dir. of Water Purif.
Toronto, Ont.

H. H. Gerstein
Chief Filt. Chemist
Chicago, Ill.

Rolf Eliassen
Prof. of San Eng. MIT
Cambridge, Mass.

Leo Louis, Jr.
Supt. Water Dept.
Cedar Rapids, Iowa

Programmers

The Insecticide Problem

THE NEW INSECTICIDES AND THEIR EFFECT ON WATER QUALITY was the title of a report by L. F. Warrick, San. Engrg. Div., Tech. Serv. Branch, Div. of Water Polln. Control, U.S.P.H.S., Washington, D.C.

Mr. Warrick's paper related to the pollutional effects of agricultural pesticides washed from the fields into streams. Severe damage to fish life was reported to have resulted from rainfall run-off following heavy application of the new synthetic organic insecticides to cotton fields in Alabama in 1950. This instance constituted a threat to a public water supply, but was kept under control by careful plant operation.

The newer organic insecticides are wonderful additions to the list of pest control materials, but their use may present a problem in stream pollution. Toxiphone, DDT, BHC, TEP, HETP, and Parathion are among the new insecticides listed. The toxicity of many of them is greater than that of calcium arsenate and some of them are quite stable in fields and in water, thus causing a persistent toxic effect.

The worst fish kills occurred on Flint Creek, an Alabama tributary of the Tennessee River, following repeated rains and reapplications of insecticides to cotton crops in 1950. The raw water in a public water supply killed goldfish in 18-24 hr. and the finished water of that plant was fatal for gold fish, but to a much less degree than the raw water. Mr. Warrick attributed the water plant removal of these toxicants to their low solubilities and to the absorptive effects of the silt load in the stream, which silt was removed in the water plant.

Learning of this situation, the affected farm advisory agencies and the insecticide manufacturers moved to disseminate the proper advices to cotton growers, and Mr. Warrick was complimentary of this immediate cooperation.

Mr. Warrick listed known toxicities of many of the new pesticides and also pointed out other potential hazards from the overuse of these economic poisons without the health of the stream being taken into consideration. He pointed to the obvious necessity for good filter plants and good control of them on such streams. He appealed to experiment stations and farm agencies to recognize this threat and to consider it in preparing their farm recommendations. He appealed to water plant men to aid in building up a record of stream quality by adding tests for these compounds to their routine during the crop dusting seasons.

Problems of Taste and Odor

TASTE AND ODOR PANEL DISCUSSION ON SPRING RUNOFF PROBLEMS. Leo Louis, Jr., Supt. Water Dept., Cedar Rapids, Ia., presided over this panel discussion.

In opening the discussion, Mr. Louis classed the spring runoff problem as an inherent one for water plants using water sources which are partly frozen in the winter months and which pass through abrupt changes during the spring thaw. He proposed no solution of the problem—instead, the problem would be pointed up as the panel saw it from experience in several middle west plants.

In the case of his Cedar Rapids, Iowa, plant, he attributes the cause of the taste and odor during the spring runoff of the Cedar River to the flushing action of the spring rains. The river usually is frozen nearly to its bottom and the free ammonia is greatly increased in the water at the end of winter, reaching a maximum of 1 to 2 ppm. NH_3 nitrogen. The threshhold odors reached 90 to 95 during the first 10 days of March 1952. Using 6 ppm. carbon the taste was reduced to a "disagreeable, sour, musty and chlorinous" classification. Laboratory tests showed that 25 ppm. chlorine would be required for breakpoint chlorination, but full scale equipment was not available to apply this treatment.

MARCUS P. POWELL, Assoc. Prof. of Hygiene and Preventive Medicine, Univ. of Iowa, told of work on the Iowa River Basin. If the river is frozen over in the winter, "musty" tastes and odors are to be expected in the spring. Usually, conventional treatment, including breakpoint chlorination, will work but sometimes the net result is a "nauseating" increase in the taste of the finished water.

Prof. Powell feels that the tastes and odors may be "manufactured" in the water treatment plant and that the taste compounds in the finished water are new and different from those in the raw water. His work shows that under such conditions ozone is preferable to chlorine as the major oxidant exployed. Operation of a pilot plant using aeration, chlorination and ozonation in several ratios and sequences showed that the problem changed as rapidly as the river changed.

GEORGE S. LEE, Production Mgr. of the Ottumwa Water Dept., told of their recent experiences on the Missouri River. He said that the problem had been reduced in severity by treatment of the Des Moines sewage and that, in general, the present problem on the upper Missouri was not as serious as that of the smaller streams. The problem was essentially one of high color and tastes and odors. The oxygen consumed and chlorine breakpoint requirements were roughly parallel to the turbidity curve of the raw water.

He agreed with Prof. Powell that the odors from chloro-compounds were more objectionable than the original odors in the raw water. Dechlorination with copperas removed the excess chlorine and helped some. His experience indicated that alertness was the principal factor in controlling the taste and odor problem in his plant. He advocated a program of carefully watching the river, many threshhold odor tests, continuous breakpoint chlorination, and an increase in carbon application as being the safest for his plant. He felt that the heavy flocculation of the water in his plant was of considerable aid in removing the tastes and odors.

J. F. Erdei, Chemist for the Omaha Metropolitan Utilities District, discussed the Omaha problem. A survey of the Missouri River in 1946 showed that taste and odor difficulties were the principal treatment problem in the basin.

He felt that this was due to noxious algal slimes, sewage and trade wastes, decaying vegetation, and silt from agricultural and industrial sources. Tannins from decaying vegetation cause darkened color of the raw water. Color is a good indicator of odor to follow later in the water.

Coagulation is very helpful in controlling algal odors, and breakpoint chlorination provides some alleviation of the problem when the tastes are present in the spring runoff water. Carbon forms an important part of his taste control program. The amount used may be as high as 200 lb. per million gallons. Using breakpoint chlorination, good coagulation, and activated carbon, he was able in general to reduce the threshhold odor from 20 in the raw water to 5 in the finished water.

James Sampson, Consulting Engineer, Howard R. Greene Co., formerly with the Iowa State Health Dept., summarized the Iowa spring runoff taste and odor problem. Agreeing with the previous speakers that the full solution was not known for this problem, he thought that tannins were responsible for the color increase and listed molds and other lower vegetable forms as being possible contributors to the production of the tastes and odors.

In discussion, it was evident that the taste and odor problem is of wide concern and that no one solution is successful.

New Orleans is having personnel from its plant specially trained at the PHS Environmental Health Center in Cincinnati for taste and odor work.

Appleton, Wisconsin. Mr. Gallagher reported that the real trouble

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Richard Hazen
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New York City

lay in the sudden onset of difficulties in the spring runoff. As high as 60 ppm. activated carbon would keep the cold water usable but the hot water would remain odorous.

Toronto, Ontario. Mr. Howard reported that super-chlorination with a minimum of 2 hours contact time, and dechlorination with SO_2 was used at his plant. A lesser contact period than 2 hours was not successful.

Acheson, Kansas. Mr. Culp of the Kansas State Dept. of Health reported that breakpoint chlorination was eliminated as a solution. As high as 48 hours contact time was tried.

Adrian, Michigan. Mr. Langworthy of The Chlorine Institute reported on 1951 spring runoff difficulties. At the Adrian plant, after stopping softening and prechlorination, more alum was added to settle mud in the first of two settling basins and then chlorine was added to provide a free residual between the first and second settling basins. The results were good. In 1952 the treatment included the use of chlorine dioxide and "water tasted fine all through the spring runoff."

[The following reports were prepared by N. M. de Jarnette, Asso. Dir., Water Pollution Control, Georgia Dept. of Health.]

Problems of Water Intakes

River Intakes on Variable Streams were discussed by Vance C. Lischer, Homer & Shiffrin, Consulting Engineers, St. Louis, Missouri.

Problems encountered include changing levels, bottom conditions, shore lines, ice, drift, etc. Intake sites should be selected after careful investigation of all conceivable conditions. Inadequacy of records on many streams dictates use of anticipated maximum water elevations above previous records. Mr. Lischer cautioned against expensive intakes on navigable streams as the U. S. Engineers have the right to change the channel. On streams where elevations vary greatly pumps should be selected only after careful study of stage records. In cold areas submergence of from 6 to 10 feet is necessary to prevent freezing.

The following type intakes were described and illustrated by pictures: (1) Fixed intakes; (2) Siphon; (3) Floating barge; (4) Movable carriage; (5) Low River stage. In certain geological formations Ranney type wells are applicable. Recently several submersible pump installations have proven successful. Mr. Lischer stated that the siphon type intake has given good service at the St. Louis County Water Works, that it is relatively simple to install, less expensive than other types and that advance warning of floods is ample to permit raising motors above expected high water, although such units are then out of service.

In discussion which followed Mr. Richard Hazen inquired if the screens on the siphon type intakes plugged badly and was informed that the only trouble of this nature encountered at St. Louis had been from occasional slush ice.

In response to a question by L. H. Enslow as to applicability of the Ranney wells in the St. Louis area it was stated that the U. S. Ordnance plant across the River took 50 mgd. from gravel wells but that the water was harder than the river water.

Service Installation Practices

A Survey of Service Line Installation Practices was reported by Mr. Walter A. Peirce, Manager Water Department, Racine, Wisc., who presented statistics gathered by Committee E7S from 210 cities of 30,000 or more population. He reported 5 persons in the United States and 5.35 in Canada per active account; in 139 cases service connections are installed by the utility; 39 utilities tap mains on top, 57 on the side and the others at some angle between horizonal and vertical; taps and service lines of equal diameter are used in more cases than otherwise; many utilities exceed specifications for size of taps in small mains.

Six basic service pipe materials studied include copper, brass, wrought iron, lead, galvanized iron and steel. Of those reporting, 51% used copper, 14% copper and lead and 11% copper and galvanized iron.

In reply to a question concerning use of plastic pipe Mr. McDowell of Charleston, S. C., reported he has had limited experience with this material in corrosive soil and to date it has been satisfactory. Mr. J. J. Carmichael, Salter, Missouri, reported the successful use of plastic pipe up to 1" or 2" diameter. He stated the

¾ inch pipe was available in lengths up to 500 feet and cost about one third that of copper.

Mr. Gerald E. Arnold, Director, Water Resources Division, N.P.A., Washington, D. C., reporting on the copper situation stated that no relief appears in sight for at least two years and urged water works utilities to try plastics. He cited one eastern utility which has installed some 5,000 plastic service lines.

Other points brought out in the discussion were that plastic pipe could be worked in cold weather by soaking fittings and ends of pipe in hot water and by use of lubricants; certain plastics may be eaten by rodents; the bursting strength of some pipe may be exceeded by severe water hammer; hot water lowers its strength, and that any possible toxicity is under study by the Sanitary Foundation of Ann Arbor.

Studies of Packing Materials

JUTE AND OTHER YARNING MATERIALS USED IN BELL AND SPIGOT PIPE is the title of a study reported by Charles A. Black, Black Laboratories, Gainesville, Florida. He described a uniform test procedure developed for such studies which to date has been applied to untreated jute, treated jute, Fibrex, asbestos, cotton and Packmaster. Growth of test bacteria was decidedly prohibited by the treated jute and asbestos and to a slight degree by Fibrex while cotton, untreated jute and Packmaster promoted bacterial development. Jute treated with copper or mercury compounds apparently did not release salts in toxic concentrations. Conclusions reached were that untreated jute was not satisfactory; treated jute seems to have many desirable characteristics with a possible exception being its mercury content; treated jute should have an identifying color and that a better test for mercury than that in Standard Methods should be devised. Mr. Black suggested that the Jute and Oakum Institute examine its process to see if the mercury compounds are being used in excess of that necessary. Mr. Wm. E. Holy, U.S.P.H.S., Washington, D. C., commented that mercurial treated jute has been used in London apparently without ill effects but that mercury probably is cumulative in the body. Certain phenol mercuric compounds are known to be skin sensitizers from which mercury may be taken into the body by cutaneous infusion. Data on this subject is meager but it is being pursued by the U.S.P.H.S.

Mr. Holy challenged water works engineers to design a joint which would prevent entrance of caulking material into the pipe.

Vance C. Lischer
Cons. Engr.
Horner & Shifrin
St. Louis, Mo.

H. O. Hartung
Plant Engr.
S.L. Co. Water Co.
St. Louis, Mo.

Charles A. Black
Consultant
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Water Works Practice Committee Session

Mr. Louis R. Howson, Alvord, Burdick & Howson, Chicago, Illinois, Chairman of the Water Works Practice Committee, outlined the work of this Committee since the last meeting for the purpose of keeping the members informed and of securing their advice. He reported new or revised specifications completed or nearing completion on valves; flanges on steel pipe; elevated tanks and standpipes; repair and painting elevated tanks and standpipes; and asbestos cement pipe. Other specifications in various stages of preparation or revision include cast iron pipe; laying cast iron pipe; connections on mechanical joint pipe; and service line materials.

Mr. H. O. Hill, Bethlehem Steel Company, Bethlehem, Pennsylvania, who is Chairman of the Committee on steel pipe flanges and on elevated tanks commented on various details, including efforts to make all welding specifications uniform.

Harry Jordan announced further work would be required on the hydrant specifications before final Committee action.

The use of torque wrenches in laying mechanical joint pipe was discussed and considerable difference of opinion as to their effectiveness was expressed by those present.

H. O. Hartung, St. Louis County Water Company, Chairman, Committee on Up-flow Contact Basins, whose report has been completed, was requested to hold his Committee intact for possible further study. Several members expressed thought that at some rate below the advocated design capacity these basins can be made to function fairly well but that design rates are not suitable for peak loads. Mr. Hartung thought that shock loads might be better handled with chemical doses considerably above those conventionally employed, at least with turbidities up to 5,000 ppm.

[The following reports were prepared by F. W. Kittrell, Field Advisory Services, Isotopes Div., AEC, Oakridge, Tenn.

Reservoir Report

OPEN AIR RESERVOIRS—COMMITTEE REPORT, Chairman, Norman J. Howard, Director of Water Purification, Filtration Plant, Toronto, Ontario.

The Committee has studied the subject of open air reservoirs for treated water storage for five years. On the basis of its studies and the answers to two sets of questionnaires, one to state and provincial sanitary engineers and the other to consulting engineers, the Committee has recommended:

1. Cover all future reservoirs and existing reservoirs where practicable.
2. Fence open reservoirs or bar public from grounds.
3. Improve specifications for reservoir construction materials.
4. Prepare recommendations for cleaning, including post-treatment.
5. Investigate chemical treatment to control algae.
6. Approve Public Health Bulletin 296, on protection of reservoirs.

In support of the Committee's recommendations, Mr. Howard pointed out that open reservoirs often permit recontamination of water that has been purified at considerable expense. Improperly protected reservoirs sometimes make it impossible to meet standards for potable water. He cited reports of 19 cases of night swimming in open reservoirs, and the recovery of nine disintegrated human bodies from reservoirs. The Committee has not completed its report because of disagreement by members of the purification Division with the recommendations on covering. The objections are based principally on the costs involved. He asked for discussion that would resolve the disagreement.

In the discussion that followed, five of the six discussors expressed gen-

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eral agreement with the Committee's recommendations. The report will be submitted to the Committee on Water Works Practice for action.

Radioactivity Tests

INSTRUMENTATION AND METHODS FOR TESTING RADIOACTIVE CONTAMINATION IN WATER. Task Group Report. Chairman, H. H. Gerstein, Chief Filtration Chemist, South Dist. Filt. Plant, Water Purif. Div., Chicago, Illinois.

This Task Group was appointed to:

1. Prepare a treatise on detecting radioactivity in water.

2. Review methods for measuring radioactivity in water.

Technical consultants to the Task Group feared that over-simplification might result from attempts to reduce the problems of detection and measurement to a practical operating level for water plants. The Task Group concluded that the subject can be presented without undue complication, and that the operator can familiarize himself with it and perform the necessary determinations. He needs to be equipped to detect and measure radioactivity that may result from atomic warfare and from peacetime operations, including nuclear plants and reactors, uses of radioisotopes and possibly nuclear power plants in the foreseeable future.

An atom is radioactive when its nucleus disintegrates spontaneously to emit ionizing radiation. The radiation may consist of:

1. Alpha particles, which are helium nuclei, and can be stopped by a sheet of paper.

2. Beta particles, which are electrons and can be stopped by a sheet of aluminum.

3. Gamma rays, which are electromagnetic radiations, most of which can be stopped by 5 centimeters of lead.

The curie is the unit of measurement of radiation. It is the amount of a radioactive material that emits 3.7×10^{10} disintegrations per second. The microcurie, which is one-millionth of a curie, is more commonly used in water monitoring. The water plant operator may find it necessary to measure radioactivity in the range of 1 to 10^{-7} microcuries per milliliter, or 2,220,000 to 0.22 disintegrations per milliliter per minute. Background radiation due to natural causes may give 20 to 120 counts per minute. Measurements in the lower portion of the range are difficult and require concentration of radioactivity in water samples by evaporation.

Water with 10^{-7} microcuries per milliliter of unidentified radioactivity generally is acceptable for drinking, but if radium is present a lower limit should be imposed. In temporary emergencies the following maximum values may be used for beta activity:

Length of Time	Safe	Microcuries per Ml. Acceptable
10 days	3.3×10^{-8}	9×10^{-8}
30 days	1.1×10^{-8}	3×10^{-8}

Five methods of measurement, based on the level of radioactivity involved, appear applicable in water monitoring:

1. Emergency field surveys, with Geiger Mueller survey meter.

2. Landsverk Model L-75 Analysis Unit.

3. Continuous indicating and recording monitors.

4. Proportional counter range, with evaporation of sample as necessary.

5. Radiochemical separation. Not commonly applicable except by agencies such as state health departments, large water plants and universities.

The Task Group recommended that its status by changed to that of a standardization committee.

A STUDY OF "SO-CALLED" ELECTRICAL TREATMENT OF WATER FOR BOILERS. Rolf Ehassen, Prof. of San. Eng., and Herbert H. Uhlig, Asso. Prof. of Metallurgy, Mass. Inst. of Technology, Cambridge, Mass. Read by P. E. Powell, Hackensack Water Co., Hackensack, N. J.

The electronic age has spawned a great many gadgets which are extravagantly advertised as simple and inexpensive cures for numerous water supply difficulties. A typical one claims to control scale electrically, by simply plugging it in, at no more cost than that of operating an electric clock. Others claim almost magical control of corrosion, algae, bacteria and turbidity. Such claims must be viewed with skepticism, since the results of many years of excellent research by the water works profession can not be swept aside by magic.

Application of three tests to such claims usually will reveal the truth about the devices:

1. Comparison of the claims with actual performance.

2. Examination of the pseudo-scientific language used.

3. Evaluation based on established scientific principles.

Examples of applying these tests to some of the advertising material were given.

Claim: Chlorine and other disinfectants kill bacteria but not the larvae. This device kills the larvae. *Fact:* Bacteria do not have a larval stage.

Claim: Odor is created by scale and humus in pipes and by chlorine reacting to create phenols. *Fact:* Most odor is in the water itself, and not in the scale. Chlorine does not create phenols.

Claim: The device prevents corrosion by changing para-hydrogen to ortho-hydrogen, without altering the chemical content of the water. *Fact:* There are no para- and ortho- forms of hydrogen.

Claim: Ionizing radiation accomplishes ionic changes that control deposition and corrosion without changing the chemical nature of minerals in the water. *Fact:* If nothing is taken out, added, or changed, nothing is accomplished.

Claim: A small current between an anode and a cathode prevents corrosion and foaming, makes bath water positive to the body, eliminates radicals, provides the perfect base for health and controls diseases due to these factors. If not effective in 10 days, see a doctor, since the condition is beyond hope. *Fact:* No comment necessary.

Most of the claims are based on some mysterious electrical action. No effects of electrical current on water treatment were found in a thorough British investigation. There is nothing mysterious about the established method of cathodic protection against corrosion, but it does not prevent scale. The principles of scaling and methods for its control have been evolved from years of research and

experience. No new and simple method will be developed overnight.

Water Hammer Symposium

The new Fourth Division, established at the Miami meeting to deal with distribution system problems, but not yet named at the time of its first session, got off to a promising start with an introduction by President Berry and a lively presentation of opinions on standard allowances for water hammer.

ARE STANDARD ALLOWANCES FOR WATER HAMMER DESIRABLE ON ALL TYPES OF WATER PIPING? S. Logan Kerr, Consulting Engineer, Flourtown, Pa.

In water pipe design standard allowances are incorporated for pressures in excess of normal static or working pressures to prevent damage due to water hammer. Despite cooperative examination of the problem by the American Water Works Association, the American Society of Civil Engineers, and the American Society for Testing Materials during the past 21 years, there is a tendency to apply standard allowances for cast iron pipe to other types of pipe.

Allowances first were developed in 1890 for low velocity gravity lines to reservoirs. New developments since that time, such as higher velocities, centrifugal pumps, check valves and other devices in lines, indicate a need for reconsideration of the standard allowances. More economical design might result. Their application to all types of pipe, to distribution systems, and to automatic control and quick closing valves might well be questioned. It may be asked whether present standard allowances are substitutes for or supplements to good engineering.

STANDARD ALLOWANCES FROM THE VIEWPOINT OF THE CONSULTING ENGINEER. This paper by Frank A. Marston, Partner, Metcalf and Eddy, Boston, Mass., was read by E. Sherman Chase, Cons. Eng., Metcalf and Eddy, Boston, Mass.

Theories of water hammer that are available for simple pipe systems are not applicable to complex networks. Since computations are not possible for the more complex systems, allowances must be made with proper consideration of the individual situation. Centrifugal pumps, subject to sudden stoppages through power failure, have intensified the problem. This is being met by increased attention to pumping stations, with incorporation of relief valves and surge chambers. Present allowances probably are adequate for distribution systems, but not for long supply mains.

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Pressures due to water hammer probably are several times as great as static pressures, but little experimental information is available. It is possible that the smaller pipes of distribution systems, which are not subject to analysis, should have higher allowances. Reconsideration of present practices is recommended.

SHOULD THE EXISTING INFORMATION FOR STANDARD ALLOWANCES FOR CAST-IRON PIPE BE REVISED?, by Thomas F. Wolfe, Managing Director, Cast Iron Pipe Research Asso., Chicago, Ill.

Pipe manufactured at present on the basis of values developed in 1886 gives satisfactory service. Although computations can not be made for distribution systems, lack of consumer complaints indicates that present practices are adequate. There is little evidence of failure of weaker portions of the system such as lead service and corroded pipes. In one case 15 open hydrants closed simultaneously created several hundred pounds of pressure due to water hammer, but no breaks in small service lines resulted. Direct pumpage into a main by a reciprocating pump caused water hammer with each stroke and resulted in leaks nearby, but the extra pressure dissipated before reaching the distribution system and no failures resulted.

Water hammer can be minimized by use of modern control devices. Operators can be trained to close valves slowly. Large intermittent users can be required to pump from storage, or other sources than mains, to provide surge chambers, or to adjust their withdrawals from the system to smaller continuous rates. In some cases other factors than water hammer, such as heavy truck loadings, may be considerations in pipe design. Many failures result from unstable foundations. Present standard allowances have proved satisfactory and lowering them would not materially reduce pipe thicknesses.

ARE STANDARD ALLOWANCES NEEDED FOR STEEL PIPE IN WATER WORKS? by Walter H. Cates, Manager, Hydraulics Division, Consolidated Western Steel Division, Los Angeles, California.

In systems with normal pressures, if the calculated pressure for instantaneous closure is less that 47 per cent of the safe working pressure, no allowance for water hammer is needed. If the calculated pressure is greater than 47 per cent, an allowance must be computed. The comparable figure for high pressure systems is 80 per cent. Auxiliary devices, such as slow closing valves, may be used to minimize water hammer and reduce the need for thicker pipe. Normal design to meet requirements due to external pressures usually is adequate to take care of water hammer, and consulting engineers rarely increase pipe thicknesses because of this factor. Calculations should be made for each situation, but in general there is no need for standard allowances for steel pipe.

ARE STANDARD ALLOWANCES NEEDED FOR ASBESTOS-CEMENT PIPE? by Arthur J. Maahs, Chief Engr., Transite Pipe Dept., Johns-Manville Sales Corp., New York, N.Y.

Pipe design must include adequate safety factors for all variables, such as working pressures, external and internal pressures, street loads, trench instability and water hammer. Johns-Manville originally tested all lengths of asbestos-cement pipe at hydraulic pressures twice those of normal working pressures. Later the test pressures were increased to four times working pressures. Twenty years of experience and the increased demand for this type of pipe have proved the design and testing procedure to be adequate.

Federal specifications require testing on representative samples of pipe at only two and one-half times working pressures. The American Water Works Association proposes testing at three times working pressures. The specific pipe needed should be selected on the basis of water hammer

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computations for long mains. Experience has proved that the design for meeting hydro-static pressures is adequate and standard allowances are not needed for asbestos-cement pipe.

ARE STANDARD ALLOWANCES NEEDED FOR REINFORCED CONCRETE PIPE, COMBINATION LOCK-JOINT PIPE, AND PRESTRESSED LOCK-JOINT PIPE? by Hugh F. Kennison, Chief Engr., Lock Joint Pipe Co., East Orange, N. J.

Water hammer due to shutting down a centrifugal pump can be controlled by specifying a minimum closing time. Relocation of a line to avoid a high peak or provision of relief valves can prevent serious hammer caused by breakage of the water column at the high point. A surge discharge device that discharges water at the instant water hammer occurs is available. Three types of reinforced concrete pipe are available, with reinforcement including helical cage reinforcement, a wire wound steel cylinder, and reinforcing rods. The ranges of pressures for each type were given. The reinforcement is designed and tailor made to meet specific conditions. Thirty years of testing and successful operating experience have proved the designs to be adequate. Some lines have operated at more than 150 per cent of design pressures without failure. Present specifications are adequate without special allowances, and in some cases may be excessive.

GENERAL DISCUSSION OF SYMPOSIUM. Charles H. Capen, Chief Engr., North Jersey Dist. Water Supply Comm., Wanaque, N.J.

A pipe splitting because of water hammer is a terrifying sight. Pump stoppages and sudden closures of check valves can make an entire building vibrate. Terrific hammer may occur in gate houses. Water hammer blew up a wash water pipe in a pressure filter. A pump failure caused a two and one-half inch plug to crack and concrete slabs in the street were washed out. When a system was changed to high pressure, failures resulted in a cast iron line designed for low pressures and laid before A.W.W.A. specifications were written.

In designing a new Wanaque system, computations indicated that three-eighths inch pipe would be adequate, but seven-sixteenths inch pipe was selected to allow for water hammer and corrosion. Water hammer occurs only on a closed system, and need not be considered if there is an open reservoir on the system. The subject of standard allowances should be reviewed.

In discussing these papers, LAURENCE G. LENHARDT, General Manager, Board of Water Commissioners, Detroit, Mich., pointed out that water hammer is caused by many factors other than pumping. Frequently the causes are in areas not subject to supervision by the water department. In one case flushometer type toilet valves caused a break in a six inch line. In another, water hammer occurred over a four square mile area during rest periods for 1000 women using 80 toilets in an industrial plant. This finally blew up the water line to the plant. Sudden closure of a hydrant blew up range water heaters over a large area. Plans to remove an elevated tank were abandoned when water hammer occurred following closure of the tank line, and the tank had to be retained as a surge chamber. All allowances are based on new pipe, but the pipe changes in service. A 30 inch pipe failed after many years of service. It was found to be laid improperly, but the actual failure was set off by water hammer due to a sudden pump stoppage. The slightly greater cost of heavier small pipe may be paid for in 10 years by lowered operating cost. Avoidance of one break can save the extra cost. Present standard allowances should be reviewed.

SAMUEL B. NELSON, Assistant Chief Engr. of Water Works, Dept. of Water and Power, Los Angeles, Calif.

Many types of water consumers can cause trouble due to water hammer. Among these are large intermittent users, consumers pumping against distribution system pressure, and fire companies. Time control devices for valve closures are needed. In Los Angeles, with some 80 pressure systems, only trained operators are allowed to close valves. Data on water hammer tests in penstocks of power plants should be useful to the water works professon. A committee should assemble such data. The experience of distribution system operators should be reviewed to determine to what extent standard allowances may need to be revised.

In the discussion from the floor, it was pointed out that adequate consideration usually is given to water hammer in transmission lines. The fact that water hammer is indeterminate in distribution systems should be a challenge. Breaks usually result from coincidental occurrences, of which water hammer is one. Two task groups are under consideration, one to review water hammer and the other, to review experiences with and causes of pipe failure.

Steel Pipe Committee Open Session

COMMITTEE PROGRESS REPORT. Chairman, William W. Hurlburt, Cons. Engr., Los Angeles, Calif., and Vice-Chairman Arthur H. Price, Specification Engr., Dept. of Water and Power, Los Angeles, Calif.

Mr. Price presented the report of progress and the plans of this Committee, which was established to develop standard specifications for steel pipe, and protective coatings and linings therefor. Two types of specifications for coal tar enamel, based on pipe sizes, have been prepared. Specifications for concrete lining are complete. The committee will develop specifications that will define the final result to be achieved rather than the method to be used.

There is some question regarding desirable thickness of cement-mortar lining. Tests have not revealed any eccentricity in three-sixteenths inch lining for pipe up to 24 inches and in one-quarter to one-half inch linings for pipe above 42 inches. For exterior protective coating three-quarter inch cement mortar with chicken wire reinforcement may be used. A manual for manufacture and installation of steel pipe is in progress.

INSTALLATION PROCEDURE FOR LARGE DIAMETER PIPE. Max K. Socha, Engr., Water Distrib. Div., Dept. of Water and Power, Los Angeles, Calif.

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New industries, air conditioning, and other new uses of water are causing the per capita demand in Los Angeles to increase twice as fast as the population is growing. Expansion of the distribution system requires new mains up to 60 inches in diameter. Many interests are involved in these additions to the already complex underground utility systems.

Minimizing interference with traffic during installation is a major problem. Traffic department requirements may add materially to the cost. Efforts may be made to force rerouting of water mains from logical locations. Costly work stoppages during rush hours may be necessary, lengthening the time required for the work and increasing the antagonism of abutting property owners. Streets must be replaced to meet the requirements of the city engineer. Stable bedding for the mains, stabilized backfill, and streets restored to grade are necessary.

Several additional points were brought out in the discussion that followed. Concrete cradles may be used to prevent distortion due to heavy overlying loads. A 72-inch pipe changed from low to high pressure raised the pavement four to five inches, because of previous horizontal distortion. Stalls should distort the pipe vertically just enough to permit it to return to a circular shape under the pressure of the stabilized fill.

SOME DEVELOPMENTS IN TESTS OF COATING FOR STEEL PIPES. Graydon E. Burnett, Asst. Chief, Engr. Labs. Branch, and Charles B. Masin, Bureau of Reclamation, Denver, Colo.

Mr. Burnett summarized experimental work of the Bureau of Reclamation both on protective linings and on coatings for penstocks. Twenty materials for preventing internal corrosion were tested in a section of 15 ft. diam. penstock in actual service. The last inspection was after two years and four months exposure. Performance was judged by rust spot formation. Tests also were made to determine resistance of materials to atmospheric temperatures as low as —41°F. Coal tar enamel cracked at —38°F.

A summary of results thus far indicates:

1. Various linings materials including phenolic, vinyl, neoprene, and vinyl thiokol are adequate. Most are economically competitive with coal tar enamel, but neoprene and flame sprayed thiokol are expensive.

2. Coal tar enamel must be plastic to withstand cold.

3. Unless cement-mortar is to be kept wet, provision must be made to minimize shrinkage by preshrinkage and air entrainment.

4. External bituminous coating must have substantial wrapping, well bonded to the enamel and with a good bead on the overlap, to provide protection in clay soils.

5. Cold applied polyethylene and vinyl tapes give good protection, especially for joint work.

THE NEW STANDARDS FOR STEEL WATER PIPE FLANGES. Chairman H. O. Hill, Asst. Chief Engr., Fabricated Steel Construction, Bethlehem Steel Co., Bethlehem, Pa.

Mr. Hill presented the report for the Subcommittee on Design of the Joint A.W.W.A.-A.S.M.E. Committee on Standard Dimensions of Flanges for Steel Water Pipe. Formerly there were no standards specifically applicable to flanges used in water works practice with pipe sizes greater than 24 inches. The committee started with consideration of existing specifications based on the pressure vessel code and recognition of the need for adapting pipe flanges to flanges on valves and other fittings. It was concluded that less confusion would result if class numbers in agreement with existing classes of cast iron pipe were used. Three companies contributed the results of research costing fifty to sixty thousand dollars.

The standards developed are for slip on steel flanges, with and without hubs, for sizes up to 48 inches. Present outside diameters and drillings are retained, but the lighter flanges proposed should result in considerable saving. The committee will prepare recommendations for flanges between 48 and 96 inches in diameter.

Water Resources Division Holds Two Sessions

GROUND WATER RECHARGE. Finley B. Laverty, Chief Hyd. Engr., Los Angeles Flood Control Dist., Los Angeles, Calif.

More than two-thirds of the water supply in the southwest is taken from underground. Until recently, when additional surface water was brought in, more than 75 percent of the water supply for Southern California came from underground. The ground water recharge method used depends on the local situation. Soil characteristics govern percolation rates, which vary widely. Where land is cheap, furrow spreading which covers only 12 per cent of the area with water is useful. If land is costly, basin percolation using 80 per cent of the land area may be used.

Where cleaner water is not available sewage may be used for recharging. In the absence of other wastes difficult to control, with biochemical oxygen demand below 30 parts per million, and with properly controlled percolation rates, all coliform organisms can be removed. Costs for various recharge methods range from $8.00 to $25.00 per acre foot compared to values of $15.00 to $40.00 per acre foot for water supply. The present demand for water in California is exceeding the available supply and ultimately it may be necessary to reclaim sewage, and possibly go to the Colorado River also for additional water.

CONTROL OF UNDERGROUND WASTE DISPOSAL. Norman I. Billings, Chief, Hydrology Div., Water Resources Com., Lansing, Michigan.

In the absence of Mr. Billings, Chairman of a Task Group on this subject, T. L. Vander Velde, Asst. Engr., Div. of Water Supply, State Dept. of Health, Lansing, Mich., gave a brief summary of the Task Group report and a description of underground water pollution in Michigan.

Geo. W. Peavy, Genl. Mgr., Dept. of Water, San Francisco. *Albert E. Hintz*, Manager, Dept. of Water, Oshkosh, Wis. *Reeves Newsom*, Village Mgr., Scarsdale, N.Y. *Chas. Barry**, Salesman, Badger Meter Co., Guthrie, Okla. *Russell H. Babcock*, Asst. Mgr. Util. Div., Foxboro Co., Foxboro, Mass. *Fred. G. Gordon*, Asst. City Engr., Chicago, Ill. *Ralph H. Lancaster*, Sup't. Water & Sewage, Kearney, Nebr.

*Charlie Barry is the oldest living member of the S.W. Section; was a charter member of the old South West Water Wks. Assn.

The Task Group canvassed city officials and state, provincial and territorial sanitary engineers on underground waste disposal. Many replies indicated no recognition of a problem due to such practice. A few reported localized problems in heavily populated areas. Bacterial contamination was the most frequent type of pollution reported. Several cited pollution by oil well brine and other industrial wastes. The general indication was that no serious problem exists, but the Committee proposes to continue its work through consultation with A.W.W.A. sections and selected national organizations.

In Michigan, 75 per cent of the public water supplies are taken from underground. Bacterial contamination is widespread, but is not serious and generally can be controlled. The authority of the State Commission to control underground pollution is being tested in a court case involving possible pollution of ground water by wastes from a metal plating plant. The company claims the U.S.P.H.S. standards for toxic materials in drinking water are not valid. If the Commission's authority does not prove adequate an agency with authority to make arbitrary decisions may be necessary to protect the public health against potential hazards. The Task Committee still has a big job to do in assembling factual information.

Artificial Ground Water Recharge. Task Group Report, by Chairman Charles H. Bechert, Dir., Div. of Water Resources, Indiana Dept. of Conservation, Indianapolis, Indiana.

The Task Group was appointed to study events, trends, and developments in artificial ground water recharge. Questionnaires were sent to water resource agencies in all states requesting information on the extent of recharge practice, potentialities of recharging and possible need for legislation pertaining to artificial recharge. Replies from 33 states indicated a belief that existing laws could regulate underground disposal of waste water. In four states recharge is practiced on a regional basis. Other projects are for specific supplies, including 10 for public water supply, nine for industrial supply, and eight for irrigation supply. The majority are in California and the eastern seaboard states. A few reported recharging with reclaimed sewage or wastes, but most viewed such possibilities with extreme caution.

Industrial Water Use. Task Group Report. Chairman Herbert E. Hudson, Jr., Head, Engrg. Subdivision, State Water Survey, Urbana, Ill.

The Task Group was established to study water requirements of specific industrial operations and develop consumptive requirements per unit of product. Thus far it has limited its activities to review of work already in progress by others in this field. Industrial requirements are about three times the amount distributed by public supplies, and water works men are among the minority in water use. Use of conservation practices should be encouraged. Industry is inclined to take process water for granted, with little attention to waste. A survey of available water resources is needed. Data on industrial water costs should be compiled. Establishment of water quality requirements for some seven classifications of industrial use might aid in conservation through avoidance of appropriating water with higher quality than needed. There are wide differences in interpretation of the term "consumption," and the Task Group recommends that it be defined to mean "destruction of usefulness."

At present industry can have access to water only by locating so that water may be obtained through riparian rights or ownership of land overlying groundwater. Greater flexibility in methods by which industry may obtain rights to suitable water is needed. Industries might join in water projects with towns which have rights of eminent domain. The Task Group has developed a classification system which incorporates information needed for any interest and plans to investigate avenues of future usefulness.

Evaporation Research at Lake Hefner. G. Earl Harbeck, Jr., U.S. Geological Survey, Los Angeles, Calif.

Lake Hefner, which is one source of water for the Oklahoma City supply, was chosen for extensive research on evaporation because of the completeness with which all inflow and outflow could be measured. Extensive test drilling showed no loss of water underground. Because of the extremely small watershed there was little direct inflow even during heavy rains. These factors permitted exact determinations of evaporation. Data on lake volume, temperature changes, heat storage, and radiation, wind velocity and direction, humidity and rainfall were obtained to permit computations by the energy transfer theory. The highest evaporation rate was during the fall when the air was dry and the water warm. No existing theories or formulas were found to be applicable. For example, during April the pans showed evaporation during one period when water was condensing on the lake. It is anticipated that the work will result in the development of new basic equations that will be applicable elsewhere.

Discussion was presented by Morrison B. Cunningham, Supt. and Engr., Water Dept., Oklahoma City, Okla. One reason Lake Hefner is so ideal for this type of research is because it is filled by gravity through a canal from another source, and all inflow can be measured accurately. The evaporation ranged between the negative value of —0.5 inch in February and nine inches in August.

Long Range Water Supply Planning for Wichita. A paper prepared by Robert H. Hess, Supt. and Chemist, Div. of Water Supply, Wichita, Kans., and presented by R. E. Lawrence, Black and Veatch, Cons. Engrs., Kansas City, Mo.

With the exception of the depression years, Wichita has grown rapidly. Population estimates for the year

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2000 vary between 310,000 and 500,000. Water supply plans call for an ultimate 75,000,000 gallons per day capacity to serve 425,000. The city purifies water and sells to a water company, which handles the distribution. Methods of meeting the anticipated future demand include: maximum development of the existing well field; partial increase of the well field with a supplemental supply from the North Fork of Ninnescah River; and partial expansion of the well field with supplemental supply from the Bureau of Reclamation Kannapolis Reservoir. Partial expansion of the well field with future supplement from Kannapolis can be accomplished in easy stages and will assure the maximum ultimate capacity. This plan will be submitted to the citizens for a referendum on a bond issue.

SEALING ABANDONED WELLS. Committee Report, by Chairman, James C. Harding, Commr. of Public Works, Westchester County, White Plains, N.Y. Read by Reeves Newsom, Village Manager, Scarsdale, N.Y.

The Committee was requested to prepare specifications for sealing abandoned wells, but decided to prepare a recommended procedure instead, because no single specification could cover the ranges of different types of well construction and geological formations. The recommendations may be used as a guide both in actual practice and in drawing up state legislation. Objectives of well sealing are to eliminate physical hazard, prevent contamination of ground water, conserve yield and hydrostatic head, and prevent mixing of desirable and undesirable waters. Complete details of practices and procedures for sealing various types of wells will be found in this comprehensive report.

W.W. Administration

(Open Committee Session)

In the open session held by the Committee on Water Works Administration (W. R. LaDue, Chmn.) subjects of greatest interest discussed were the following:

Radio: Opinions were to the effect that in failing to make greater use of two-way radio, water works men were missing a very excellent opportunity to improve service and reduce expense in general operations.

Fire Insurance Coverage: It was felt that a committee might well be established to study the current problem of re-evaluation of water works property and re-negotiation of coverages by fire insurance companies in the light of rising costs and the resultant high price of replacements. This subject may well be developed into a panel discussion at the 1953 Conference.

Safety Practices: Safety in water works is deserving of greater attention. The AWWA has taken the lead in this important branch of public employment practice. The Board having authorized the formation of task groups covering supply, treatment and pumping, distribution, and administration. At both the Miami and Kansas City conferences this live topic brought out a large amount of discussion from the floor.

Cost of Water Main Changes: Need for rethinking was apparent on the part of all concerned relative to the distribution or acceptance of costs to a water works utility, resulting from extensive road and freeway improvements such as are now being undertaken nationwide. This was a very active subject since many water utilities, large and small, have been forced to make extensive outlays to revamp facilities which are already giving satisfactory service. Water works men feel that such expenses should be repaid from freeway project appropriations.

Water Main Extension Policies: The Committee on Water Main Extension Policy now has in development a report which will take into account the ever-increasing problem of extensions of water service into suburban areas and the financing of such extensions.

Other topics also received attention but those briefed above received the major attention.

Soda Ash Specifications Issued by A.W.W.A.

Tentative standard specifications for soda ash (anhydrous normal sodium carbonate) have been adopted by the American Water Works Assn. for water purification and softening applications. The three-part standard includes sections on the material specifications, on sampling, inspection, packing, and marking and on testing.

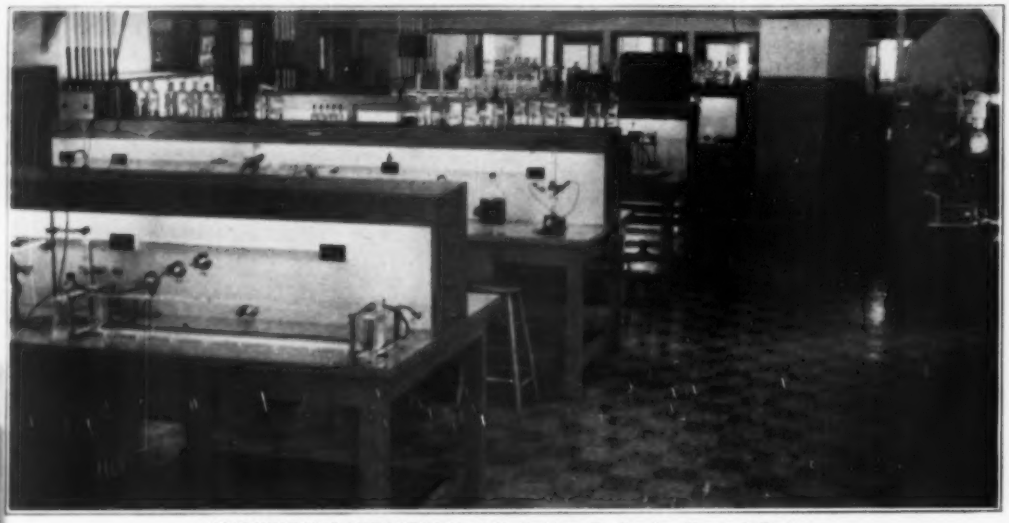
The standards are printed in a six-page booklet which may be obtained from the association upon advance remittance of 15 cents. Ask for AWWA B201-51T. Address American Water Works Assn., 521 Fifth Avenue, New York 17, N. Y.

Interesting Pollution Regulation Pact

Mass. Town and Industry Sign Agreement

A one year pollution control pact, effective June 1, has been entered into by the Hercules Powder Co. and the town of Mansfield, Mass. The pact is designed to control the amount of industrial wastes discharged into the Rumford River on a seasonal or weather basis, the quantity of wastes discharged increasing as the temperature drops.

The Company's effluent shall at no time contain less than 6 ppm of dissolved oxygen and the BOD content on any one day shall not exceed 40 ppm when the temperature is 60° F. or higher, and proportional for temperatures below 60° F. If the facilities installed by the Company fail to function, and the effluent does not meet the specifications, the Company agrees to modify its waste treatment system, reduce or curtail its manufacturing operations or take other measures to the extent necessary to comply with the specifications.



ANALYTICAL LABORATORY of the Sanitary Engineering Research Project

Sanitary Engineering Research Project of the University of California

by P. H. McGAUHEY, *Assistant Director, Sanitary Engineering Research Project, Richmond Field Station, Richmond, Calif.*

THE Sanitary Engineering Research Project of the University of California at Berkeley is an organization through which faculty members and graduate students in sanitary engineering may engage in research of either a fundamental or an applied nature. Operating around a core of full time research employees within the university's own budget, the Project represents a flexible organization within which a variable number of individual research projects may be conducted under faculty control. Its principal objectives are: (1) to provide for professional growth and increased competence of the faculty, especially the younger members, through the agency of research, (2) to offer facilities for high level advanced study in sanitary engineering, (3) to give opportunity for a limited number of graduates to become specialists through full time association with a research project in some special field, and (4) to serve California and the west by contributing to the solution of some of the area's most pressing problems of water reclamation and waste disposal.

How the Project is Directed

The Project is a part of the University's Department of Engineering, and is administered through a Director and an Assistant Director. The Director, H. B. Gotaas, Professor of Sanitary Engineering, is presently also Chairman of the Division of Civil Engineering and Irrigation. Interested faculty members serve as Faculty Investigators on each individ-

ORIGIN OF THE PROJECT

in 1949 through a special appropriation from the California Legislature

for studies of waste disposal problems in the State

granted as a result of the activities of
The Interim Committee on Water Pollution
The League of California Cities
The State Health Department and others

aware of the vast need of the State of California for
reclamation of its waste waters
satisfactory disposal of its refuse
and protection of its ground water resources

AND ITS OBJECTIVES

to serve California and the west by contributing to the solution of some of the area's most pressing problems of water reclamation and waste disposal

to provide for professional growth and increased competence . . . through the agency of research

to offer facilities for . . . advanced study in sanitary engineering

to give opportunity for graduates to become specialists
through full time association
with a research project
in some special field

MEMBERS of the Project—For identity see Box below

ual research project. Collectively, the sanitary engineering faculty constitutes a committee which reviews and advises on all projects. Matters of research policies and programs involving industry and the general public are brought before an Advisory Committee of prominent sanitary engineers in the State of California. Present members of the Advisory Committee include Mr. A. M. Rawn, Chief Engineer and General Manager, Los Angeles County Sanitation Districts; Mr. Frank M. Stead, Chief, Division of Environmental Health, State Department of Public Health; Mr. William J. O'Connell, Jr., Consulting Engineer, San Francisco; Mr. Warren H. Schneider, Waste Disposal Engineer, City of Los Angeles; and Mr. Vinton W. Bacon, Executive Officer, State Water Pollution Control Board.

Responsibility for conducting each individual research project is placed upon a Principal Investigator who is granted all possible freedom of research within the plan worked out with him by the Faculty Committee, Faculty Investigator, and the Directors. Principal Investigators may be either members of the sanitary engineering faculty, part time graduate students, or full time research engineers or scientists of a wide variety of backgrounds such as sanitary engineering, civil engineering, chemical engineering, fluid mechanics, chemistry, biology, and soil science. Assistants of equally varied backgrounds are employed on the projects on a full time basis, or as graduate students working for higher degrees, principally in sanitary engineering. Opportunity is offered for the graduate student to assume responsibility for research on some problem related to one of the projects and which is deemed by his advisers to be suitable for a graduate thesis.

How the Project is Supported

The Project came into being in 1949 through a special appropriation from the California Legislature for studies of waste disposal problems in California, granted as a result of the activities of the Interim Legislative Committee on Water Pollution, chairmanned by Mr. Randal F. Dickey;

IDENTITY OF INDIVIDUALS IN ABOVE PHOTOGRAPH

Members of Sanitary Engineering Research Project

Project Advisory Committee, Faculty Committee and Principal Investigator Group

Front row, left to right

A. E. Greenberg, Research Microbiologist; J. A. Harder, Research Engineer; H. B. Gotaas, Director, and Professor of Sanitary Engineering; P. H. McGauhey, Assistant Director; Vinton W. Bacon, Executive Officer, State Water Pollution Control Board.

Second row, left to right

Prof. B. A. Tebbens, Berkeley; Prof. A. F. Bush, U. of Calif. Research Group, Los Angeles; W. J. Kaufman, Research Engineer; B. J. Card, Research Engineer; C. W. Golueke, Research Mycologist.

Back rows, left to right

Warren H. Schneider, Waste Disposal Engineer, City of Los Angeles; Frank M. Stead, Chief, Division of Environmental Health, State Dept. of Public Health; W. F. Langelier, Professor of Sanitary Engineering; T. R. Simpson, Professor of Irrigation; Gerald Klein, Research Engineer; E. A. Pearson, Asst. Prof. of Sanitary Engineering; J. F. Thomas, Research Chemist; Ray B. Krone, Research Soil Scientist.

Absent

A. M. Rawn, Chief Engineer and General Manager, Los Angeles County Sanitation Districts; William J. O'Connell, Jr., Industrial Consultant, San Francisco; Prof. F. L. Hotes (on military leave); and Professor H. F. Ludwig (now with USPHS).

KJELDAHL Apparatus and Flame Spectrophotometer in Analytical Laboratory

the League of California Cities; the State Health Department; and others aware of the vast need of the State of California for reclamation of its waste waters, satisfactory disposal of its refuse, and protection of its ground water resources. Specifically, the appropriation was for field studies of the disposal of refuse from California cities, and of the possibility of reclaiming sewage plant effluents by spreading, direct injection into underground strata, or other methods intended to conserve waste water without endangering the public health. The studies thus begun were later continued under funds granted to the State Health Department and the Water Pollution Control Board, and by inclusion of the Project in the annual budget of the University.

Funds for conducting research on the Project came from the University and from other public agencies, or from industries, which enter into contracts with the Regents of the University for research on specific problems. Present contracting agencies include the State Water Pollution Control Board, the State Division of Water Resources, the United States Atomic Energy Commission, and the National Institute of Health. No projects financed by industry are presently under way although the Project may carry on industrial research approved by the Regents. The general policy is to undertake only those sponsored industrial studies which are not properly in the realm of private consulting practice and which are in the interest of the citizens of California. Inasmuch as the University is a tax supported institution, a charge for overhead costs is made against all projects not financed by State appropriations.

What the Project is Studying

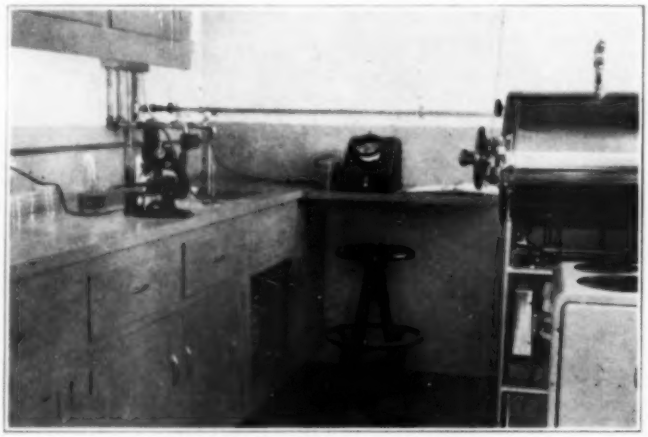
The Sanitary Engineering Research Project is located on the grounds of the Department of Engineering's new Field Station at Richmond, California. This is a 108-acre tract some seven miles from the Berkeley campus and is devoted entirely to the research activities of all engineering branches operating on that campus. One of the principal features of the Project is its laboratory, occupying approximately 5,000 square feet of floor space and equipped and staffed to serve the analytical needs of all projects.

Currently, these include studies of the reclamation of sewage by returning it to the ground water through spreading or by direct recharge into aquifers, the prevention of sea water intrusion, the economics of garbage collection and disposal, composting of refuse, the effectiveness of activated sludge in removing radioisotopes, the biochemistry of oxidation ponds, and the removal of boron from industrial wastes. Studies of sea water distillation, the thermophilic digestion of industrial wastes, and the Palmer-Bowlus flume are under way in the campus laboratories of members of the sanitary engineering faculty, who, incidentally, are free to engage in individual research as well as in Project undertakings. While outwardly the laboratory building must continue to reflect its industrial ancestry until such time as a new building program becomes possible, it comfortably houses within, the administrative offices of the Project, a library, and laboratories for chemical, biological, and radiological determinations.

Who Comprises the Staff

The Laboratory serves a dual function—analytical service to the various projects, and fundamental research into natural phenomena associated with water and waste treatment. It is supervised by Dr. J. F. Thomas, who serves as chief chemist or staff chemist in the service function of the Laboratory, and as Principal Investigator in the research function. Investigators on other projects cooperate with Dr. Thomas for routine analysis of samples by laboratory technicians under his direction, and work in the laboratory in the conduct of any studies for which they themselves have special competence.

All tests involving the use of radioactive material are conducted in two special laboratory rooms under the direction of Dr. Warren J. Kaufman,



BACTERIOLOGICAL Laboratory of the Project

Principal Investigator on the A.E.C. financed project dealing with the effect of activated sludge on the removal of radioisotopes. Dr. Kaufman serves as staff adviser in matters involving the use of radioactive material.

Mr. A. E. Greenberg, Principal Investigator on the project dealing with spreading of sewage plant effluents, serves as staff biologist.

Other projects are headed by young men of varied backgrounds. For example, J. A. Harder, a specialist in fluid mechanics, conducts the research on sea water intrusion into underground aquifers; Bradley J. Card, a sanitary engineer, and Clarence J. Golueke, a mycologist, are concerned with composting; Ray Krone, a soil scientist, assisted by Carl H. Arness, Jr., a sanitary engineer, leads the work on underground travel of pollution; William J. Oswald, a sanitary engineer, carries on the study of algae symbiosis in oxidation ponds; and Gerald Klein, a chemical engineer, assists in the study of radioisotopes.

While each specialist is responsible for research on his individual project, his advice on problems within his special sphere of knowledge is made available to all other projects. In this manner all research undertakings on the Project represent teamwork between the specialists on the job, and between those specialists and the directing faculty. The Faculty Committee and Faculty Investigator groups include Professors H. B. Gotaas, W. F. Langelier, T. R. Simpson, H. F. Ludwig*, B. A. Tebbens, F. L. Hotes, E. A. Pearson, P. H. McGauhey, and W. F. Kaufman.

The activities of the entire research team, together with those of members of the faculty who conduct important sanitary engineering research in their own laboratories on the campus, are reported periodically in a News Quarterly published by the Project.

RADIOLOGICAL Counting Equipment—Laboratory and Office

*Recently returned to U. S. Public Health Service.

LIBRARY and Conference Room of the Project

Where the Project is Going

Although the Sanitary Engineering Research Project of the University of California is organized to expand as necessary to meet the sanitary engineering research needs of the state, it is yet a young organization. Those who direct it prefer that the Project grow in a sound and orderly manner. The control exercised by sanitary engineers of the faculty and the Project serves to maintain the sanitary engineering significance of the research program. Soundness of research procedures and of the interpretation of results is achieved by employing both engineers and scientific specialists, and through consultation with many types of experts on the Staff of the University, in public service, and in private practice.

Today the Project is a well established core around which teaching, education, and graduate student programs can be integrated. It offers an opportunity for the faculty member interested in sanitary engineering research to participate in such research to whatever degree he desires, provides the organization to carry out the work, trains young engineers and others on the research staff for entry into a variety of special fields, and maintains a framework for high level training of graduate students in sanitary engineering.

Canadian Provinces Make Loans for Suburban Water and Sewage Facilities

Interesting is the fact that suburban areas adjacent to cities can borrow funds at low rates from the Provincial Government for the purpose of providing water supply and sewerage facilities in the area. A case at point is that of Jasper Place, Alberta, adjacent to the city of Edmonton. Instead of Edmonton extending water and sewage service into this suburban area the Province of Alberta is loaning to Jasper Place the funds required to finance a three-year program of improvements. The initial loan of $500,000 has already been made, with similar loans to be made in 1953 and 1954.

Municipal Water Supply of Scandinavia

Part IV—Helsinki, Finland

by E. L. KNOEDLER, *Senior Engr., Sheppard T. Powell, Engrs., Baltimore, Md.*

HELSINKI'S water supply is withdrawn from the Vanta River. The problem of availability of supply is more acute than at Oslo or Stockholm, since this river is subject to flood and drought conditions. However, the river water is impounded in five large lakes to maintain an adequate volume. The minimum reported flow of 26 cu. ft. per sec. can be raised to 32 cu. ft. per sec. and can be regulated to maintain the latter figure without difficulty. It is believed a flow of 88 cu. ft. per sec. can be maintained by lowering the lake level by 6 to 10 feet and, if necessary, by pumping from lakes outside the immediate drainage area.

Several drainage areas supply, or potentially can supply the water needs for Helsinki. The largest area represents the principal drainage area of the river and includes numerous lakes large and small. The other areas, on each side of the main drainage area, comprise additional rivers and lakes that can be segregated; the water from these can be delivered to one of the lakes in the main drainage system. In certain of these areas the water must be pumped from one watershed to another, finally reaching the main watershed where it can flow by gravity to the water treatment plant.

Water Needs Increase

The present consumption of water is 21 mgd., with a maximum plant rating of 31.7 mgd. Plans are being made to increase the capacity to 47.5 mgd. With the existing population this consumption is equivalent to 53 gal. per capita per day, appreciably above the value of 42 gal. per capita per day only ten years ago. At present, less than 5 per cent of the 400,000 population is not served by the city water plant. Most of those not supplied with city water live outside the city proper, and rely upon shallow wells for water. Each house is metered and unaccounted-for losses of water amount to only 3 per cent of the total volume, most of which is lost in the operation of the treatment plant (in the form of backwash water and water for blowdown purposes). Compared with practice in the U.S., this is an enviable record of unaccounted-for water.

Treatment Plant Design

A schematic flow diagram of the Helsinki water treatment plant is shown in Fig. 1. The raw river water is screened before delivery to a mixing chamber in which some aeration and mixing of the chemicals is accomplished. The plant design shows strong German influence. Alum is proportioned to the raw water flow by the opening or closing of a number of faucets; this arrangement is shown in the photograph, Fig. 2.

Water from the Vanta River, like most river waters in Scandinavia, is highly colored by organic matter. It has been found helpful to prechlorinate in order to secure good coagulation of these colored waters. A typical analysis of the treated water is shown in Table I.

The raw water pumps have a capacity of 7,400 gal. per min. Following the addition of the coagulant, the water flows to a large sedimentation basin consisting of three sections. In the first section, the alum treated water is settled for four hours. Following this, the water is treated in spring and fall with activated carbon for removing color and taste. The treated water is settled for four hours in the second section and then flows to the third section in which it is settled for a final four hour period. Lime water may be added to adjust the pH of the water either before or after receiving the final four hour settling.

The settled water flows to a large pump sump from which it is delivered through pipe lines to a separate building where the filters are located. Chemical feeders, as originally installed, were designed for manual control. At the time of the author's visit, these were being revamped and modernized so that the units would proportion the chemicals in accordance with the flow conditions.

The settled water is chlorinated to provide about 0.1 ppm. residual chlorine in the finished water. No ammonia is used to maintain a combined chlorine residual, and actually little chlorine remains by the time the water reaches the user.

Salt water intrusion made it necessary to construct a dam in the river. The filter building is located near the dam and on the opposite side of the river from the units previously described. One extremely serious problem has been that of ice formation which has made it necessary to supply live steam at the intake to prevent freezing and cutting off of the supply. One year the town was without water because of a quick freeze.

Table I
ANALYSES OF RAW WATER SUPPLIES, HELSINKI, FINLAND

Constituents	As	Parts Per Million, Average Vantaanvesi	Jokivesi
Calcium	Ca	11.80	25.20
Magnesium	Mg	4.60	4.10
Sodium	Na	1.80	1.90
Chloride	Cl	9.20	9.50
Sulphate	SO_4	12.80	40.80
Nitrate	NO_3	4.30	4.30
Bicarbonate	HCO_3	27.70	31.10
Silica	SiO_2	26.20	7.70
Aluminum	Al	6.30	0.80
Iron	Fe	3.30	0.14
Manganese	Mn	0.07	0.06
Ammonia	NH_4	0.24	0.21
Sum		108.3	125.8
As Calcium Carbonate:			
Calcium Hardness		29.5	63.0
Magnesium Hardness		19.1	17.1
Total Hardness		48.6	80.8
M Alkalinity		22.7	25.6
Oxygen Consumed by Permanganate		66.7	16.4
Conductivity mm.		111.1	168.6
Evaporated Residue		144.6	125.8
Volatile Residue		46.5	29.9
Ignited Residue		98.1	96.0
Color—Pt		190.0	1.0
pH		6.9	7.1
Temperature °F		47.0	48.0
Dissolved Oxygen		10.4	11.3
Carbon Dioxide		5.0	3.0

Per cent oxygen saturation varies from 67-94%.

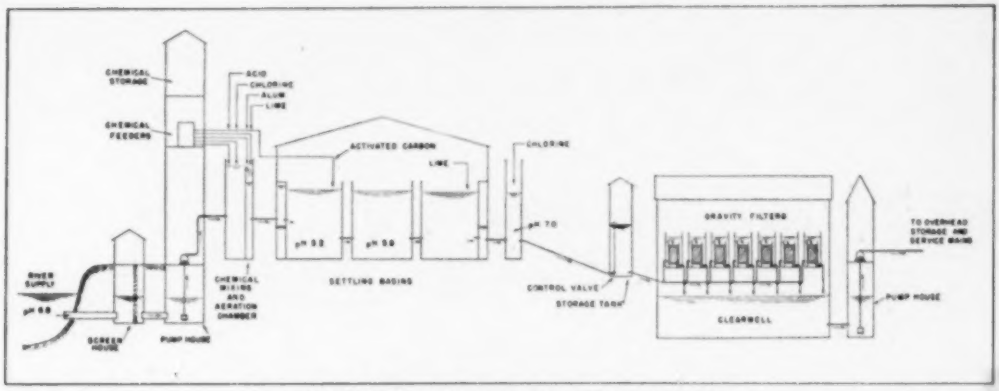


Fig. 1—FLOW DIAGRAM of Water Treatment Plant, Helsinki, Finland

The treated water is delivered through lines to the filter buildings some distance downstream. In one of the buildings circular type filters are installed. These are equipped with mechanically operated rakes, similar to those used in many of the older filter installations in the U.S., but which are seldom found in plants at present. The circular filters are operated at a normal flow rate of 2.5 gal. per sq. ft. per min., which is somewhat high.

In a new filter building additional filters of more modern design are being installed and placed in operation. The flow rate for the new filters will be set at 2 gal. per min. per sq. ft. When these new units have been completed, it will be possible to lower the rate on the old circular filters to the same value.

The present filters are backwashed for 10 minutes every 44 hours. Normally, following backwashing, the filtered effluent is delivered directly to the distribution line, but if the filter unit has been out of service for over 6 hours, the water first filtered is wasted.

The filter plant includes a well equipped laboratory with necessary facilities for carrying out mineral analyses, bacterial examinations, tests for biochemical oxygen demand, and other special tests. The final water is clear and relatively free of color.

The Distribution System

Filtered water is delivered to the system at a rate of 7400 gal. per min. The main pipe line is 40 inches in diameter, and the distribution system lines are constructed of steel with lead joints. Some of the smaller lines are of cast iron and the individual lines into homes are of copper. All large pipe lines are asphalt coated and wrapped to protect them from the acid soil.

In general, gravity flow delivers the water from reservoirs to the city. To supply the suburbs of the city which are built upon hills, it has been necessary to install booster pump stations. There is a second delivery line connecting 10,000 feet of tunnel with the suburban area. In the past year, only 20 pipe failures were recorded in the entire system. In order to meet peak conditions of load, two large reservoirs having a capacity of 71.5 mil. gal. have been installed in the city. The estimated cost of the treated water is 19 cents per 1000 gal.

Chlorination is intended to maintain a low residual of about 0.1 ppm., but tests at city taps indicate losses in transit reduce the residual to about 0.02 ppm. in the delivered water. The water is tested every four hours for chlorine residual. Although only a low chlorine residual is maintained, tests indicate the absence of coliform organisms.

Fig. 2—COAGULANT feed device
Series of faucets proportion alum to raw water

Across the river from the present filter plant there is an old building in which are housed the first pumps used to deliver water to the City of Helsinki. These still are capable of being operated and are powered by a waterwheel which presently is used during high water conditions as a small source of power.

Acknowledgment

The author wishes to express his appreciation to Mr. Eino Kajaste of the Municipal Water Works of Helsinki, Finland, for his courtesy and helpfulness in making it possible to visit the water plant at Helsinki.

[Previous articles in this series by Mr. Knoedler dealt with the water supplies of Oslo, Norway, in the March issue; with that of Copenhagen, Denmark, in the May issue; and with that of Stockholm, Sweden, in the June issue. This is the last of the articles on Municipal Water Supply of Scandinavia. The next and concluding article in the series will deal with sewage disposal as practiced by these same cities.]

Cole Becomes Supt. at Pineville, La.

B. G. Cole, until recently Chemist of the Water & Sewage Dept. at Shreveport, La., has resigned to accept the position of Superintendent of Water Works Dist. No. 3 at Pineville, La. Prior to his Shreveport position Mr. Cole was Supt. of Water Treatment at Monroe, La.

F. M. Leiper Made Supt. of Water at Wellsville, N. Y.

Succeeding E. J. Rowe, retired, who held this position for 31 years, F. M. Leiper has been made Supt. of Water at Wellsville, N.Y.

NEW GRINNELL, IOWA, PLANT—Primary Clarifier, Control Building and Digester, Final Clarifier

Modern Sewage Treatment For Grinnell, Iowa

Small City Incorporates Old Facilities For Economical Construction of Secondary Treatment Plant

by H. S. SMITH, *Partner, Stanley Engineering Co., Muscatine, Iowa*

GRINNELL, Iowa, the home of Grinnell College, has placed in operation a completely modern sewage treatment plant. The fact that the project was undertaken upon the City's own initiative and recognition of its responsibilities without force or order from an outside agency is a tribute to the City of Grinnell and an example for other communities. Although this small city of 7,500 population faced a problem common to many communities and solved it by basically conventional methods, the vigor with which it was attacked and the careful attention to detail have resulted in an exceptionally well executed project incorporating several details unique in plants of this size.

The new plant is essentially a conventional separate sludge digestion-trickling filter type. The design is unusual in the utilization of existing facilities whose effectiveness had been largely overlooked in prior considerations. Integration of these facilities into the new plant resulted in a substantial saving with no sacrifice of arrangement or details which are important to a well designed, easily operated plant.

Scope of Problem

The treatment plant is located on a small creek about 1.5 miles southwest of the City. All sewage reaches the plant by gravity through a 22 in. outfall sewer. The upper part of this sewer follows an artificial lake utilized for recreational purposes and a source of industrial soft water supply. Excessive wet weather flow resulting from high infilteration rates in the old sewers and illicit storm water connections caused surcharging of the outfall sewer and frequent overflow into the lake.

The original sewage treament plant, constructed in 1914, consisted of an Imhoff tank, sand filters and sludge drying beds. The plant was expanded in 1927 by the addition of a sprinkling filter, a plain humus tank, an open sludge storage tank and additional sludge beds.

With satisfactory primary treatment, the capacity of the sprinkling filter would have been sufficient for the tributary population. However, the original Imhoff tank did not provide the necessary degree of primary treatment. As a result, the secondary treatment facilities were badly overloaded and their effectiveness was impaired by large amounts of solids and grease which the primary facilities failed to remove.

The gross pollution of the lake and creek caused by overflow from the sewers and by inadequate treament were quite properly a source of concern to the City.

Plan for Improvement

The City Council engaged the writer's firm late in 1948 to conduct a survey and make recommendations for the most feasible means of overcoming the problems described. As a result of this survey and subsequent studies, the following recommendations were made:

1. Construction of a relief sewer to carry full capacity of upstream sewers around the artificial lake without overflow and construction of a diversion device to bypass flows above 2.0 mgd. (or about 4 times the dry weather flow) into the stream below the lake.

2. Complete modernization of the treatment plant to incorporate grit removal, flocculation, sedimentation, separate sludge digestion and standard rate trickling filtration. This type of treatment would provide the required minimum 90 per cent B.O.D. removal and would allow maximum utilization of the usable portions of the existing plant.

It was mandatory to prevent sewage overflow to the lake under any circumstances. However, diversion of combined sewage and storm water in excess of 4 times the dry weather sewage flow to the stream below the lake could be tolerated because of dilution by the higher stream flow occurring under conditions producing overflow. Moreover, flows in excess of the di-

version rate were found to be of only short duration so that total quantities diverted would be small.

Every effort was made to utilize all possible portions of the existing treatment facilities. The existing sprinkling filter was in reasonably good structural condition and of such size that loading could be limited to not more than 350 lb. B.O.D. per acre foot per day at present population if 45 per cent removal could be achieved by primary treatment. The existing sludge storage tank was in good structural condition with a volume about 50 per cent of total digestion capacity. Ample sludge bed area could be cheaply obtained by converting one of the existing sand filters to this use. The value of these units represented about one-third the cost of a completely new plant.

New Equipment

It was recommended that the necessary degree of primary treatment be obtained by utilizing diffused air in a combination grease flotation and flocculation tank. This would achieve more effective removal in the primary settling tank as well as a reduction of grease which had long been a source of difficulty in the existing plant. Preaeration also would offset the septic tendency of the raw sewage resulting from the long outfall sewer.

In order to improve filter operation it was recommended that the existing filter be equipped with a rotary distributor and two feet of rock be added to increase rock depth to 8 feet. This would offset loss of volume in the corners of the rectangular filter not reached by the distributor and increase nitrification over that achieved by the original 6 foot rock depth.

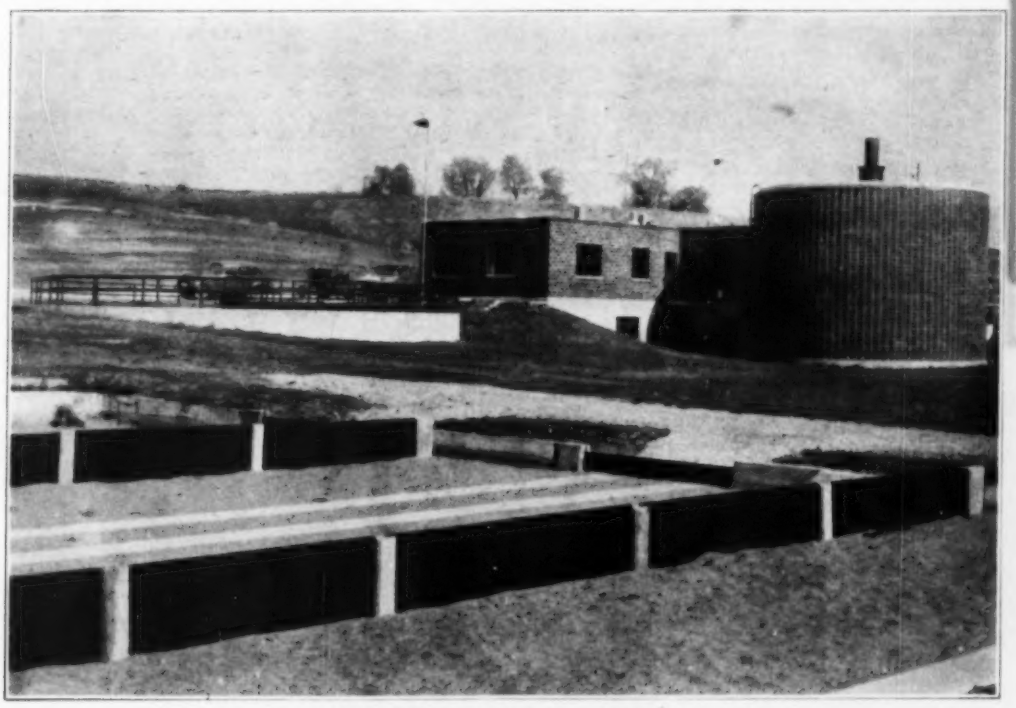
The existing sludge storage tank could be utilized as a second stage unheated storage tank following a new heated first stage digester. This would permit a 50 per cent saving in size of the new digester, with the advantages of stage digestion not often incorporated in plants of this size.

In summary, the recommended new plant construction included the following units:

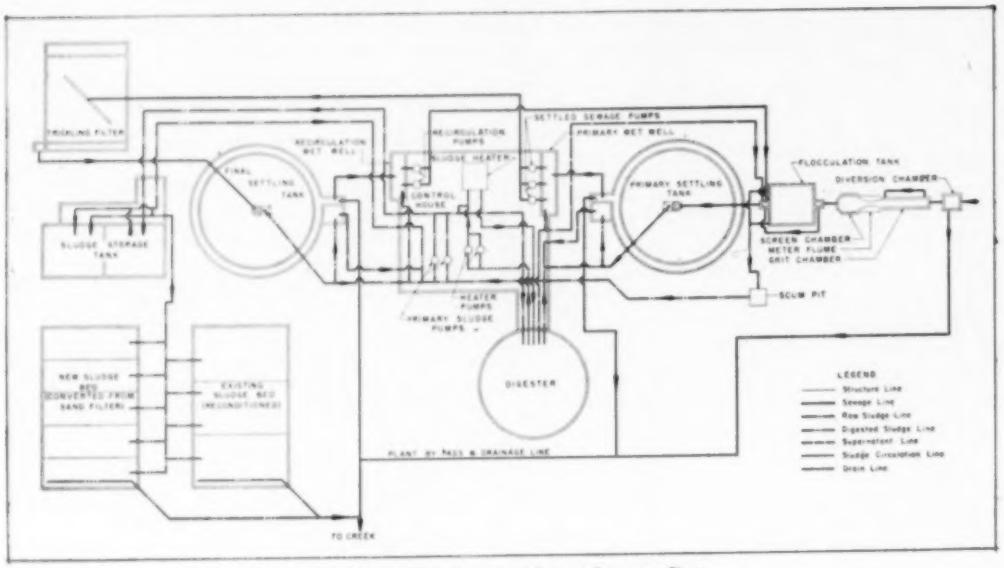
1. Mechanical grit removal.
2. Parshall flume for flow measurement and grit chamber velocity control.
3. Mechanical screening.
4. Diffused air flocculation and grease flotation.
5. Mechanical primary and final settling tanks.
6. First stage heated sludge digestion.
7. Control building with adequate facilities for plant operation, maintenance and control.

A design population figure of 11,000 persons was adopted. Average design flow on the basis of extended gagings was 550,000 gal. per day with a 2 hour design rate of 825,000 gal. per day used for grit removal, flocculation, grease removal and settling facilities. It was further recommended that the hydraulic capacity of the plant be ample to allow passage of 2.0 mgd. Although sewage analyses performed during the survey showed a raw B.O.D. loading of only about 0.1 lbs. per capita per day, a loading of 0.167 lbs. per capita per day was used for the design, thus allowing considerable margin for changes in sewage strength which might be caused by future developments.

These recommendations were studied at length by the City Council and were approved by both the City Council and the Iowa State Department of Health. Final planning of the project was then authorized.



RECONDITIONED Sludge Beds below Final Clarifier
Note first floor entrance to gas control room and basement entrance to digester pipe gallery



Grinnell, Iowa—Flow Diagram of Sewage Treatment Plant

Relief Sewer

The relief sewer consisted of 1700 ft. of 24 inch pipe and 660 ft. of 21 inch pipe, paralleling the existing sewer to a point below the lake spillway. Vitrified sewer pipe with cold bituminous joints was used throughout.

The upper end of the relief sewer terminates in a diversion structure designed to limit the flow reaching the old sewer to the capacity of that sewer and to divert all excess flow to the new relief sewer. The diversion structure below the lake consists of a side overflow weir which retains flows up to 2.0 mgd in the sewer and bypasses flows above this amount to the creek below the lake spillway. The combined capacity of the relief and existing sewer systems is 6.0 mgd, slightly in excess of the capacity of the sewer system above the upstream diversion structure.

In addition to construction of the relief sewer, two badly deteriorated exposed, concrete encased, pier-supported sections of the old sewer between the relief sewer and the treatment plant were replaced with asbestos bonded, asphalt paved invert, corrugated metal pipe and the supporting piers were either replaced or restored to provide sound, water tight construction at these points.

The relief sewer system has been in operation since March 1951 and has proved completely effective in preventing overflow to the lake. Diversion of excess flow below the lake has occurred several times but no ill effects in the creek have been noted. Frequency of diversion will be reduced as the City continues to eliminate sources of surface water entrance to the sewers.

Treatment Plant

The accompanying illustrations show general features of the treatment plant. A description of various units, in order of flow through the plant, is as follows:

1. A diversion structure provides double side overflow weirs and a sluice gate by means of which flow to the plant can be regulated or bypassed.

2. A grit chamber, metering flume and mechanical screen is included in a single structure. The grit chamber is equipped with Link Belt straight line type equipment having a 30 ft. active length which discharges to a wheelbarrow at the top of the channel. A 6 in. Parshall flume, immediately downstream from the grit chamber, serves the dual function of raw sewage metering and grit chamber velocity control. This flume together with the cross sectional shape of the grit chamber controls velocity in the grit chamber from 0.7 ft. per sec. to 1.1 ft. per sec. at flows from 350,000 to 2,000,000 gallons per day. A Builders-Providence float operated transmitter, located adjacent to the flume, operates in conjunction with an indicating, recording and totalizing meter on the control panel in the control building. A Chicago Pump Co. 15M Comminutor, a manually cleaned bypass, and an emergency bar screen are located at the end of the channel immediately downstream from the Parshall flume.

3. A hopper bottom diffused air grease flotation and flocculation tank provides a detention of 45 min. at design flow with air at a rate of 0.15 cu. ft. per gal. of sewage. This tank is equipped with a single row of carborundum diffusor plates set in Pacific Flush Tank Co. holders in the bottom of the tank. Air is supplied by an 85 cfm Roots-Connersville blower located in the basement of the control building. Chain Belt Co. rotating type scum and grease withdrawal troughs are located at the surface on either side of the tank. Scum and grease is discharged through these troughs to an adjacent scum well from which it is pumped to the digester.

4. A 45 ft. diam. x 6 ft. water depth primary settling tank is equipped with a Dorr Co. SiFeed clarifier using automatic skimming. Sludge may be withdrawn from the tank directly by either of two Marlow simplex plunger sludge pumps in the control building basement, or by gravity through a slip pipe, into a sludge well adjacent to the tank from which it can be pumped to the digester. Normal operation has used gravity withdrawal to the sludge well. A specially designed rack and pinion operated slip pipe permitting quick raising and lowering and fine adjustment has proven much superior to screw thread operated arrangements and has al-

lowed the controlled withdrawal of a very thick sludge.

5. Two 800 gpm and one 400 gpm Fairbanks-Morse horizontal pumps for settled sewage discharge directly to the filter distributor. Sewage pumps are located in the basement of the control building. The wet well is located on the outside wall of the control building with approximately the top half covered with grating and opened to the outside, thereby providing ample ventilation. There are no wet well openings to the inside of the building.

6. The existing sprinkling filter has been converted to a trickling filter by the addition of a 112 ft. diameter Dorr Co. rotary distributor, and by the placement of 2 ft. of quartzite rock on top of the original rock providing a total media depth of 8 ft. Deteriorated concrete in the gallery and walls of the filter was restored by sand blasting and Guniting. Short sections of the existing walls were raised 2 ft. to contain the added rock. Underdrainage and collection systems of the existing filter were satisfactory.

7. The new final settling tank is a duplicate of the primary settling tank except that no skimming is provided on the collection mechanism.

8. Recirculation of plant effluent to the primary tank influent is accomplished by one 200 gpm and one 400 gpm Fairbanks-Morse horizontal sewage pump in the basement of the control building. Liquid to be recirculated is discharged from the final tank effluent box to a recirculation well (arranged identically to the settled sewage wet well at the opposite side of the building). Recirculation is provided for the maintenance of minimum flow rather than for a higher degree of treatment.

FLOCCULATION and Grease Flotation Unit
Screen Chamber, Meter Flume, and Grit Chamber in background

9. A new 30 ft. diam. by 30.5 ft. deep heated sludge digester has been constructed adjacent to the control building. This operates in conjunction with the rehabilitated existing sludge storage tank to provide a total sludge digestion and storage capacity of approximately 3 cu. ft. per capita, half of which is in the new heated digester. The new digester is equipped with a Pacific Flush Tank Co. floating cover. The digester and control building are heated by a 250,000 BTU per hour Pacific Flush Tank Co. automatic gas or oil fired sludge heater and heat exchanger located on the first floor of the control building. Digester contents are circulated through the heat exchanger by two 150 gpm Fairbanks-Morse horizontal bladeless impeller sewage pumps located in the basement of the control building. Pacific Flush Tank Co. gas metering and control equipment, and all digester control piping and valves, are located in isolated rooms in a bay separating the digester from the control building and accessible only from the outside. Supernatant may be discharged either to the primary settling tank or the trickling filter through a four-level drawoff system.

10. One existing sand filter was converted to a five-compartment sludge bed and the existing sludge bed was divided into three compartments, thus providing a total sludge bed area of 16,600 sq. ft. Each compartment is provided with concrete truck runways.

11. An Allen Bradley unit motor control center is located in the office and laboratory space is provided on the first floor of the control building. The raw sewage flow meter is also mounted in a special compartment in this center.

The control building is located between the primary and final settling tanks with direct access to these units. The hillside location permits grade entrance to the first floor at the front of the building and to the basement and digester pipe gallery at the rear of the building. All pumping equipment is located in the basement. Office, laboratory and control center are located in one room on the first floor. Also on the first floor are the sludge heater and gas control rooms

RECONDITIONED Sprinkling Filter with Rotary Distributor
Final Clarifier in Foreground

GRINNELL, IOWA, SEWAGE TREATMENT PLANT

List of Suppliers of Principal Equipment

Grit Collector—Link Belt Co., "Straightline"

Raw Sewage Meter—Builders-Providence, Inc., "Chronoflo"

Screening Machine—Chicago Pump Co., "15 M Comminutor"

Preaeration & Grease Flotation

Aeration Plate Holders—Pacific Flush Tank Company
Revolving Scum Skimmer—Chain Belt Company
Blower—Roots-Connersville Blower Corp.

Settling Tank Equipment—The Dorr Company, Type S-7

Filter Distributor—The Dorr Company, Type KC-B

Digestor Equipment

Floating Cover—Pacific Flush Tank Company
Gas Controls—Pacific Flush Tank Company
Sludge Heater—Pacific Flush Tank Company

Pumping Equipment

Sludge Pumps—Marlow Pumps, #PE Simplex Sludge Pump
Raw Sewage Pumps—Fairbanks, Morse & Co., Trash Pump Fig. 5423
Recirculation Pumps—Fairbanks, Morse & Co., Trash Pump Fig. 5422
Digestor Sludge Circulation Pumps—Fairbanks, Morse & Co., Trash Pump Fig. 5422K "Bladeless Impeller"

Electrical Control Equipment—Allen Bradley Company, "Multi-Unit Control Center"

which can be entered only from the outside, a garage and workshop, wash room and shower and a tool and supply storeroom. The superstructure is of hollow tile construction with a smooth face brick interior. Hollow tile with an airspace was also used around the digester.

Yard lighting is provided for all outside operating areas. Water supply is provided by a well and pressure system. All hot water is softened in a zeolite softener. Yard hydrants for flushing are located at several convenient points around the site.

All weirs, gates, gate guides, and metal baffles are fabricated from aluminum plate.

Unusual Plant Features

Although the type of treatment described herein is conventional, the plant design and arrangement incorporates several unusual features unique to a plant of this size. Among these features are the following:

1. Maximum utilization has been made of old plant facilities which might have been considered worthless, resulting in a saving in excess of $100,000 in the cost of the plant—at no sacrifice in operating flexibility or degree of treatment.

2. All valves other than unit drain valves are located in the basement of the control building, thereby eliminating troublesome buried valves or expensive pipe gallaries between units. Flexibility for future expansion has not been sacrificed to achieve this detail.

3. Complete flexibility of operation is permitted by bypasses around all units.

4. Various safety features are incorporated in design of the plant. These include:

a. Positive separation of all areas in which gas leakage may occur from normally occupied portions of the control building and digester operating areas; entrance to these spaces is only from the outside.

b. The use of explosion proof electrical fixtures and equipment in the control building basement and in all other areas to which there is any possibility of gas escaping, other than the heat exchanger room where the open flame in the burner would counteract the use of explosion proof fixtures.

c. Positive mechanical ventilation for the control house basement and the gas control room. The basement ventilating system is manually controlled but the gas control room ventilation operates automatically whenever the door to this room is opened, and must be manually shut off. These ventilating systems provide turnovers of air once in 12 min. and once each minute for the basement and gas control room respectively. The air intakes to the ventilated spaces are equipped with heating coils so that satisfactory heating can be achieved with the high ventilating rate.

5. The use of unit type centralized motor control in a coordinated cabinet rather than the decentralized or non-coordinated types of control most commonly used in plants of this size.

6. The generally clean-cut appearance of the entire arrangement and of the individual units.

The City Council and the operating staff have developed a commendable pride in the plant. They are taking unusual steps to acquaint the citizens of Grinnell with the project and to beautify and maintain the grounds. The Isaac Walton League will completely encircle the plant site with a multiflora rose hedge this season. The City Council and the plant operator have prevailed upon the Iowa Sewage Works Assn. to hold its 1952 meeting in Grinnell so that all Iowa sewage men will have an opportunity to inspect the plant.

Construction

Contracts were awarded in May, 1950, to Lippert Bros. Inc. of Boone, Iowa and to Service Electric of Grinnell, Iowa for the sewer and treatment plant and electrical construction respectively.

Equipment was bid direct to the City. The general contractor was then instructed to purchase equipment selected by the City and his base price was increased by the amount of the equipment bids plus 10 per cent to cover purchase and handling. This procedure permitted the City to retain full control of equipment furnished, relieved the general contractor of this responsibility and avoided a multiplicity of separate equipment contracts.

Construction started in June, 1950. The relief sewer was placed in operation in the spring of 1951. Primary treatment in the new plant was started in June, 1951 and the plant was placed in full operation and accepted in September, 1951.

Construction Costs

Final contract cost of the project was as follows:

Relief sewer and sewer repair	$ 33,726.47
Treatment Plant, equipment and general construction	198,827.75
Treatment Plant, electrical	7,775.62
Total	$240,329.84

The entire cost of the project, including engineering, legal, right-of-way and administrative costs, was approximately $260,000.

It will be noted that the contract cost of the plant was only $18.80 per capita for the 11,000 design population. This low cost was achieved through maximum use of the existing facilities described herein and through

careful design, but with no sacrifice in flexibility or operating convenience.

Cost of the project was financed by sale of general obligation bonds. A sewer rental of 25 per cent of water bills was also adopted, and the balance of this revenue remaining after paying operating costs is used for bond retirement—thus reducing the general debt service tax. Approximately half of the debt service costs are provided by the net sewer rental revenue.

Operation

The plant is in charge of one full time superintendent who performs all the routine operating and housecleaning tasks as well as necessary laboratory work. Occasional help for heavier chores is provided from other city departments.

At this writing, complete laboratory routine has not been established but preliminary tests show over-all B.O.D. reduction to be in excess of 90 per cent with over 50 per cent reduction accomplished by primary treatment. These tests indicate that results in excess of those anticipated in design will be achieved.

Burnable gas was produced within a month after the digester was placed in operation, and within two months the daily production of about 1 cu. ft. per capita was established. Digester temperature of 95°F. has been maintained without difficulty, even with sub zero outside temperature. Some oil has been used to supplement gas during the most severe weather.

Grease and solids removal has been most effective. Previously, much difficulty was encountered in keeping the filter spray nozzles free. No trouble is now experienced with clogging of the distributor orifices from grease or solids carried through primary treatment.

Preaeration and recirculation at low flow have effectively controlled odors, even though there is an unusually high sulfate content in the municipal water supply. Occasional hydrogen sulfide odors over the settled sewage wet well have been noted during low flow but these have been overcome by increasing the recirculation rate to reduce primary detention.

Personnel

The project was initiated under the administration of Mayor M. F. Zimmerman, with Councilman Ray George serving as Chairman of the Sewer Committee, and was completed under the administration of Mayor Tom Godfrey, with Councilman Don Vance as chairman of the Sewer Committee. Mr. Verl Garwood is Plant Superintendent, succeeding his father who held that position for many years. The bulk of the administrative detail for the City was handled by City Clerk Homer Lowery. Resident Engineer on construction was Mr. William Nettleton, and the writer served as Supervising Partner responsible for design and execution of the project.

N.E.W.W.A. Announces Official Nominees for Offices 1952-1953

What has been tantamount to election for many years the slate of new officers for 1952-1953 in the New England Water Works Assn. has been announced by the Nominating Committee of N.E.W.W.A.—to wit:

For President—
Stanley M. Dore,
Deputy Chief Engr.,
Allegheny Co. San. Authority,
Pittsburgh, Pa.

For Vice-Pres.—*
Roger G. Oakman,
Supt. Div. of Water,
Needham, Mass.

For Director (3 yrs.)—
Edw. L. Tracy,
Director, San. Eng., Div.
Vt. State Health Dept.
Burlington, Vt.

For Treasurer—
Wm. P. Melley,
Commissioner of Water,
Milton, Mass.

*Mr. Oakman will become the Junior Vice-President, with Wm. B. Duffy, Supt. of Public Wks., North Andover, Mass., automatically moving up from the Junior to the Senior Vice-Presidency. Thereby Mr. Duffy progresses in line to becoming president of the Association in 1953.

The Secretary of N.E.W.W.A. is Joseph C. Knox, Exec. Secy., Interstate Water Pollution Control Comm. of New England. His is not an elective office, the Secretary being appointed by the Executive Board.

The 71st Annual Meeting of N.E.W.W.A. will be held in Hotel Griswold at Groton, Conn., Sept. 8-9 and 10.

Need this One a Caption?

From time to time we have advocated the use of a suggestion-box in every plant and office. The effective use here pictured is proof enough that suggestion-boxes have greater potentialities than ever.

Chlorine Industry Establishes Special Public Health Committee

Amplified by Advisory Members Representing Leading Water, Sewage and Public Health Organizations

The Public Health Advisory Committee of The Chlorine Institute, Inc., held an organization meeting July 8, 1952, in New York City. Its purpose is to develop a better understanding of the practical and scientific problems in the application of chlorine to sanitation.

The Committee is composed as follows:

R. W. Hooker*, Chairman
Hooker Electrochemical Co.

B. W. Dickerson*
Hercules Power Co.

Francis B. Elder
American Public Health Assn.

Linn H. Enslow
Federation of Sewage and Industrial Wastes Assns.

Raymond J. Faust
American Water Works Assn.

Fred W. Fraley*
Diamond Alkali Co.

A. H. Herberger
Conf. of Municipal Public Health Engrs.

Ralph M. Hunter*
The Dow Chemical Co.

S. W. Jacobs*
Niagara Alkali Co.

Warren J. Scott
Conf. of State Sanitary Engrs.

L. F. Warrick
U.S. Public Health Service

* Members representing The Chlorine Institute, Inc.

Spraying Methods for Disinfection of Small Tanks

Produces Thorough and Economical Results

by HARRY W. TRACY *and* EDW. L. FONSECA,
Engineers, Water Purification Division,
San Francisco Water Dep't., San Francisco, Calif.

IN a paper* presented at one of the California Section's Regional Meetings of the AWWA methods of disinfecting tanks and reservoirs were discussed. As the last of three basic methods a spray method was described which was then relatively new and little in the way of experience could be given at the time. Basically this method consisted of using a gas-type high pressure solution feed chlorinator to supply a heavily chlorinated water stream to a nozzle. The inside of the tanks were sprayed with this solution of approximately 500 ppm chlorine.

In a prepared discussion of this paper Herbert P. Nilmeier, Senior Sanitary Engineer, 12th Naval District, San Francisco, adaptations of the spray method to small tanks were presented. As these variations of the basic spray method were in the form of a discussion they were not published. Since these modifications would seem to be very useful to many waterworks operators, the present authors are attempting to cover the original discussion and present new data collected in the interim.

Fundamentally this disinfection procedure is most adaptable to small relatively low tanks; especially where cost, time or drainage of chlorinated water are limiting factors.

The Procedure

The procedure consists of making up a 500 ppm chlorine solution with calcium hypochlorite powder such as "H.T.H.," "Perchloron," etc., which will contain roughly 500 ppm of available chlorine, and spraying this solution on the sides and roof of the tank to be disinfected with either a hand pump or small leak pump, the latter probably being the most readily available.

In several instances the following procedure was satisfactorily used for small tanks. A chlorine solution was made up on the bottom of the tank by filling the tank with about one foot of water and adding the correct amount of calcium hypochlorite to give a solution containing roughly 500 ppm of available chlorine. Mixing was done by stirring with a broom. A civilian defense stirrup pump was then filled with this solution and the interior of the tank sprayed intermittently over a two hour period.

Under these conditions the bottom of the tank, the location of the maximum contamination, is continuously covered by the sterilizing solution. The sides and top, which are usually comparatively clean, will have various periods of contact with the hypochlorite solution during the two hours. These contact periods have been found sufficient for tank disinfections in all cases encountered.

Where the tanks were larger, and the location of the tank drain lines correct, the authors made up several hundred gallons of hypochlorite solution and placed a 50 gallon drum under the tank drain. This drum served as a suction reservoir for a 1½" leak-pump which supplied the pressure to spray the tank. On the suction side of the pump standard hose was used, while on the discharge side one-inch hose was utilized with a ¼ x 2 inch nipple serving as the nozzle. All reducers, etc., were standard pipe fittings. As this type of hook-up is usually readily available it has been used on all tank disinfections utilizing the leak-pump. In those instances where a maximum height of stream is desired a standard ¾" fire nozzle may be used to good advantage. Since the hypochlorite solution drains from the tank walls and runs out of the tank drain it replenishes the suction reservoir. The photograph shows an operator preparing to enter a tank which is to be disinfected by spraying, using a readily portable 1½" Homelite leak-pump. In this instance the pump suction is taken directly from the tank drain line.

The operator must wear a gas mask and should wear rubber boots, rain coat and hat while spraying the interior of the tank. Otherwise, no special safety precautions need be used with the pump. However, there is one precaution, the exhaust from the pump engine must not enter the tank, since most gas mask cannisters used in chlorine service will not protect the wearer from carbon monoxide fumes.

In recirculating the chlorine solution in this manner the strength of the solution should be checked periodically and if necessary more hypochlorite added to maintain the desired chlorine concentration.

Pump Corrosion

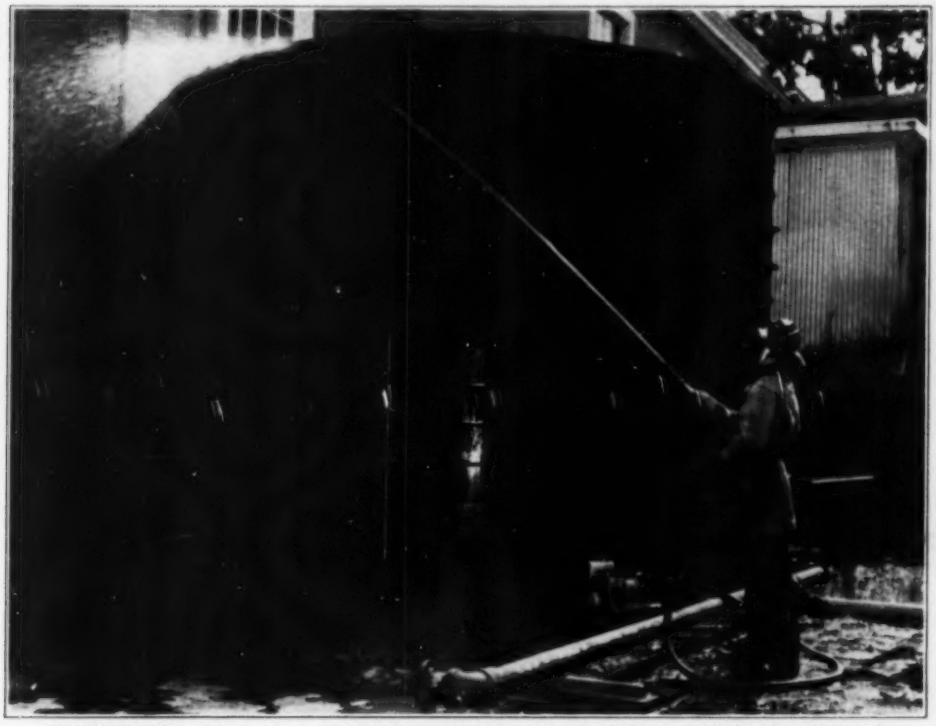
Although leak-pumps have been used in disinfection procedure without any noticeable deleterious effects, more concrete evidence on probable damage to the pump due to corrosion seemed desirable. Consequently, parts of Homelite leak-pumps were obtained, cut into coupons and immersed for various periods of time in a 500 ppm chlorine solution made from "H.T.H." It should be noted at this time that due to the high pH value in calcium hypochlorite solutions the disinfecting power is milder and also the amount of corrosion is very much less as compared with chlorine solutions made by dissolving chlorine gas in water.

The weighed and calipered coupons were immersed in 500 ppm available chlorine solutions made from high test calcium hypochlorite (H.T.H.) for seven days, after which time they were carefully examined and dried. Any corrosion products were removed by brushing with a nylon bristle brush and the sample was then reweighed and recalipered to note any changes.

Coupons made from the pump casing (an aluminum alloy) showed no visible effects of corrosion on those faces which were not broken or machined. The machined and broken sides showed some corrosion with the latter surface showing the greater noticeable effects, i.e., the adherence of a gelatinous aluminum compound. From the tests run the casing coupons gained on the average of 0.0053 grams per square inch of exposed surface, the gain no doubt being from incomplete removal of the products of corrosion.

In the case of the coupons made from the pump impeller, which is of

* "Methods of Disinfecting Tanks and Reservoirs" H. W. Tracy, J. A.W.W.A. 43, 85 (1951)



DEMONSTRATION of Spray Method of tank disinfection, showing Homelite leak-pump, and what the well dressed "spray-disinfector" will wear.

cast steel, the formation of corrosion products was much more noticeable, but here again it was the machined and broken surfaces that were being attacked. The impeller coupons lost an average of 0.027 grams per square inch of exposed surface.

In both of the above cases no change could be noted in the caliper readings down to 1/1000 inch taken before and after the tests. In actual practice the rate of corrosion would be speeded up due to the velocity of the water washing away the corrosion products, but on the other hand the corrosion would be retarded by the oxides of iron and aluminum and any oil films that might be adhering to the pump. Although the Homelite Corporation indicated they do not recommend these pumps for use in chlorine service it would appear from the above data that a standard Homelite leak-pump can be used with very little harm as a spray pump for tank disinfection, especially when the short contact times are considered. As a precaution, though, the pump and fittings should be thoroughly flushed immediately after use.

Conclusions

Although there is relatively little economic advantage in connection with tanks of less than 25,000 gallons capacity when this type of spray method is used, rather than filling a tank with 50 ppm chlorine solution. There *is* the advantage that very little water has to be dumped and the tank can be placed in service in a minimum of time, also all areas inside the tank will be covtred by the disinfecting solution. On tanks from 25,000 to 100,000 gallons there is a distinct economic advantage in this hypochlorite spray method. For example, to fill a 100,000 gallon tank with 50 ppm hypochlorite solution the cost of wasted water and hypochlorite would be approximately $30.00, while the spray method costs would be under $3.00. Labor costs would be about the same in both cases. A minimum of time and expense is required to disinfect and put into service a water tank when the hypochlorite spray method is used.

The authors wish to express their appreciation to the Homelite Corporation of Port Chester, N.Y., for supplying pump sections for testing purposes.

Winnipeg to Spend $6,000,000 on Water Supply Expansion

In a 20 year water supply expansion program, the City of Winnipeg, Manitoba, plans to spend on the average $300,000 annually for water main extensions, an 80 mg. reservoir and a new pumping station—a total of $6,000,000 over the 20 year period.

To bring more water into the city the Greater Winnipeg Water District plans a second aqueduct from the source of supply to the proposed new reservoir. An additional expenditure of $5,500,000 for this aqueduct will be paid from the District's funds.

True Enough

"Water is one natural resource that can *not* be conserved by abstaining from using it."—*Malçolm Pirnie.*

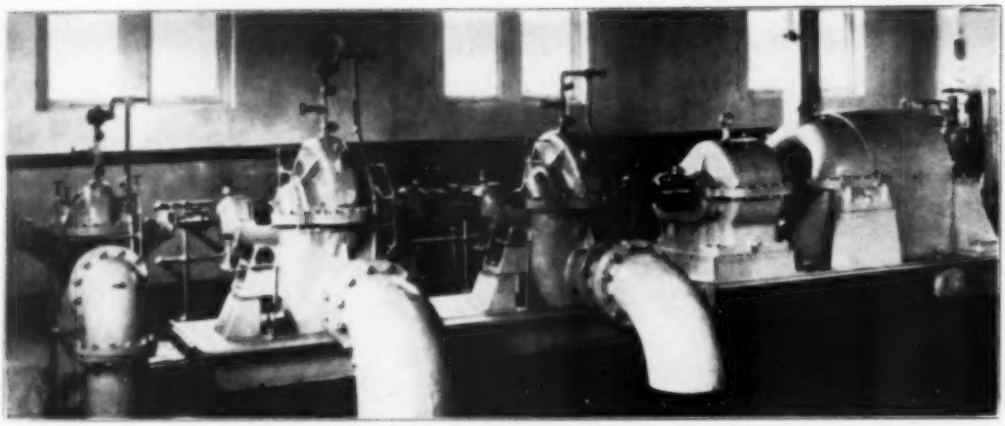


Fig. 14—Turbo-driven centrifugals in series, York, Pa., Water Co. To the left, on the common shaft, is the condenser circulating pump.

Basic Factors
In Preparing a Centrifugal Pump Inquiry

Part III*—Requirements in Specific Services.

by ROY CARTER *and* IGOR J. KARASSIK, *Application Engineers*
Worthington Corporation, Harrison, N.J.

IN the preceding two articles* dealing with effective preparation of centrifugal pump inquiries we presented in a general manner the information which should be collected, with regards to a contemplated centrifugal pump installation, in order to prepare an inquiry which will facilitate recommendation, or selection of pumping equipment possessing overall characteristics most suitable for the requirements to be met.

While all the factors outlined in those two articles should be properly investigated during the analysis of the installation, not all of them have an equal importance for the various services under which centrifugal pump applications can be classified. In order to illustrate these differences in the order of importance, there has been selected a group of representative services most commonly encountered in water and sewage works installations. In the first article the most important points to be examined have been listed for each of these services. As most pumps are constant speed motor drive, except for one item these lists have been prepared with the general thought of this type of drive. Naturally if a variable speed drive is used the operating speed can be adjusted to allow the unit to cover a much wider range of conditions than feasible with a constant speed drive. Except for the one item, i.e., turbo-centrifugal pumping units, these lists make no comments as to information needed in order to facilitate driver selections. Obviously if these units are to be purchased with the pumps, full information as to the type to be furnished should be included in the inquiry.

*Parts I and II of this three-part series, on "Preparing a Centrifugal Pump Inquiry" appeared in our March and June 1952 issues. This installment completes the series.

Water Works Services

Raw Water (source to treatment plant)

A.—Operating head range, preferably indicated in form of system head curves for minimum, normal and maximum static heads, supplemented by information as to the duration or importance of minimum and maximum head pumpage.

B.—Capacity rating at design head.

When local conditions require obtaining certain variations in capacities with variation in total head, it is advisable, before issuing a formal inquiry, to determine from one or more pump manufacturers whether or not the desired characteristics can be obtained with constant speed. If not, it may be necessary to use a variable speed drive.

With centrifugal pumps, guarantees are ordinarily limited to one head-capacity condition. There are a few exceptions, such as large capacity, specially built units. Even in such cases the manufacturers expect a reasonable tolerance on head or capacity for any secondary guarantee point.

C.—Suction conditions, with detailed information as to how these are interrelated with total head or capacity.

D.—Character of water relative to dissolved air or gases and foreign material such as grit, leaves, etc., also chemical contamination, if any.

E.—Type of installation—horizontal or vertical with full data on local conditions.

Treated Water

(1) *Direct service into mains*

A.—Rated capacity at design head with data on operating range of capacity either alone or in parallel with other units. If the new unit or units are to operate in parallel with existing units, give characteristics of these existing units.

B.—Rated head.

C.—Suction conditions.

D.—Type of installation—i.e., horizontal or vertical.

(2) *Direct service into mains with stand pipe or reservoir on the line.*

A.—Capacity at design head with information as to desired capacity at other heads if head varies with rate of pumpage or for other reasons.

B.—Rated head with data on variation in head if there will be any variation. Describe in detail.

C.—Suction conditions.

D.—Type of installation.

(3) *Long distance pumpage through pipe line to distribution system or reservoir.* Such systems necessarily involve considerable friction heads which vary with capacity. Unless pumpage is to be at a constant rate to a distribution reservoir, full data on the system should be given with information as to what is to be accomplished.

(4) *Booster services.*

Pumps for booster service may either take water from mains under nearly constant pressure and discharge it into an distribution system in which a higher pressure is needed or may take water from mains when the pressure falls below the minimum permitted and add more pressure for the area served by the pump. Without a stand pipe on the system, pumps for the first service should generally have a reasonably small head rise so excess pressure is kept to a minimum. Depending upon local conditions and the inclusion of a stand pipe those for the second type of installation may reqiure anything between a reasonably flat and a very steep head-capacity characteristic. For pumps to be used for booster service it is therefore necessary to outline in sufficient detail what is to be accomplished if the manufacturer is to make the proper selection.

(5) *Turbo-centrifugal pumping units.*

While there are few units of this type being purchased, the turbo-centrifugal pumping unit, i.e., steam turbine, reduction gear, centrifugal pump, circulating pump, condenser and condensate pump with interconnecting piping and auxiliaries involve various items which must be individually carefully selected so they make a proper operating whole. With this type of unit the manufacturer must be given very complete information not only on the hydraulic data but on the physical location in which the unit will be installed. The data needed is summarized as follows.

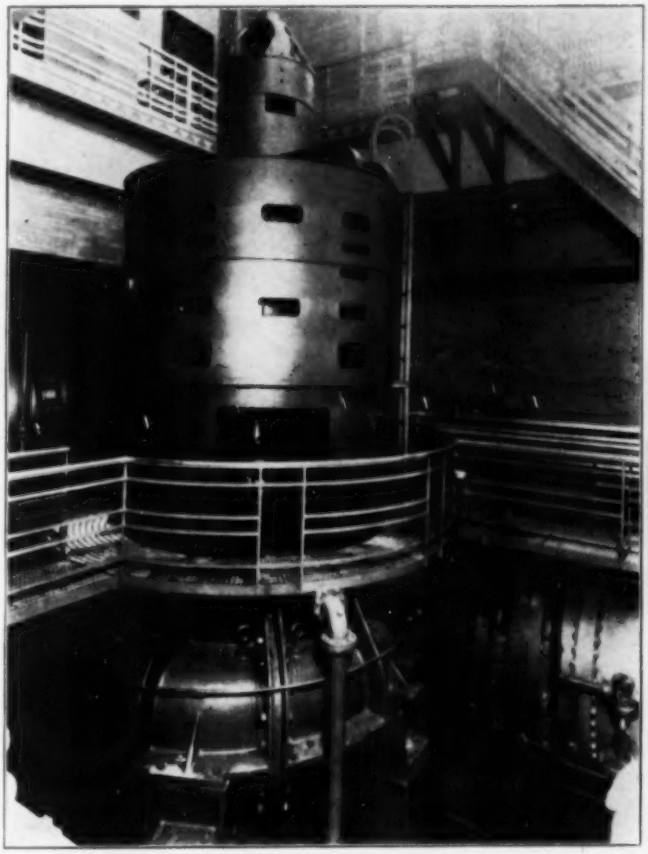


Fig. 15—Bottom-suction vertical pump, such as is used in large capacity water and sewage plants. The motor is commonly located some distance above the pump.

A.—Rated capacity and head, also giving range of capacity and heads to be met with data on suction conditions for these ranges.

B.—Data on steam pressure and superheat with range in variation for both.

C.—Range in water temperature specifying temperature at which duty guarantees are to be made.

D.—Discharge head for condensate pump.

E.—Drawing showing space available for the unit, location of basement, operating floor, source of suction supply or location of suction main and point to which discharge is to be connected.

Sewage Services

A.—Operating head range; or, whenever two or more pumps are involved, preferably a curve showing the system head-capacity characteristics. When specifying an operating head range, be sure to take into account the reduction in friction head losses with decreased capacity resulting from an increased static head and the reverse with increased capacity resulting from a decreased static head.

B.—Capacity at average or design head with limitations, if any, at other heads. Do not make unnecessary restrictions of capacities at other than design heads. To meet these may necessitate special designs with resultant unnecessary high cost.

C.—Suction conditions, with full information on how they vary with total head, capacity or number of units in service.

D.—Type of pump installation, i.e., horizontal or vertical. If vertical, and in dry pit with shafting between

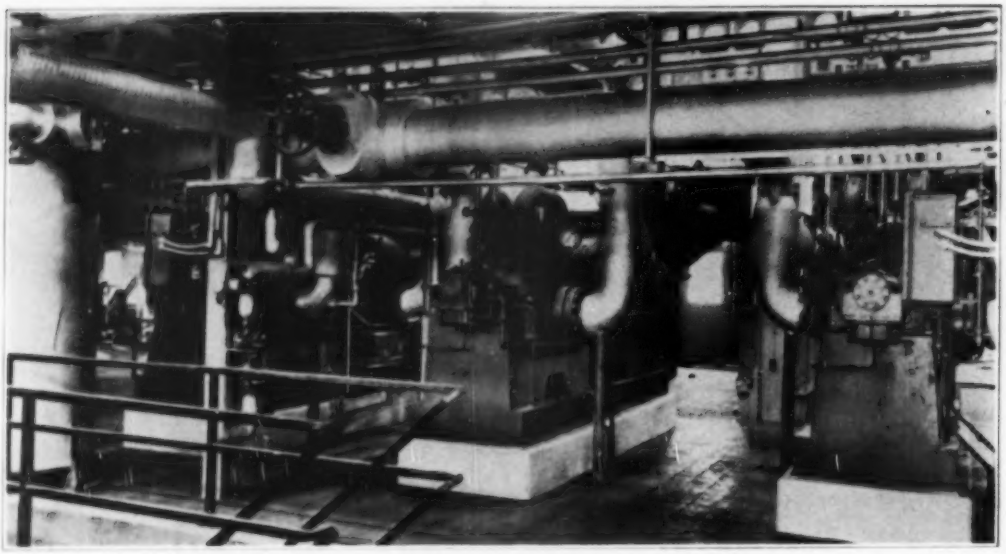


Fig. 16—Battery of high-pressure multi-stage centrifugals on boiler feed-water service. Each will deliver 850 gpm. of water at 230° F. against 1060 pounds boiler pressure.

the pump and motor or gear, advise elevation of pump pit floor, center line of suction (if fixed by existing construction) and motor supporting floor. If the vertical distance is such that steady bearings may be required for the vertical shafting, advise location of bearing supporting beams or of floors, if fixed by some local conditions. For vertical wet pit pumps, advise the distance from the supporting floor to the bottom of the pit. This, with information as to water levels in the pit, will permit the manufacturer to select proper length of pump shafting.

E.—Size of solids.

The maximum size of solids to be expected in straight domestic sewage is 2.5 inches diameter, as could be flushed down a water closet. Unless the sewage is screened or comminuted it is therefore desirable that sewage pumps on straight domestic sewage service be capable of passing 2.5 inch solids. On storm water or combined domestic and storm water systems, larger solids can be expected. It is usual practice to protect the pumps from solids larger than can pass through the bar screen ahead of the pumps. Demanding a pump design passing very large solids for the capacity involved is not desirable as it often necessitates manufacturers offering larger, more expensive and less efficient pumps than if a more reasonable smaller size solid limitation is specified.

Drainage and Irrigation

In general the specific information required for drainage and irrigation installations is the same as for sewage installations.

Boiler Feed Service

A.—Required capacity in gallons per minute or in pounds per hour, including maximum, minimum and normal. If expressed in gallons per minute, the conversion from pounds per hour should include specific gravity corrections. The total pump capacity installed, exclusive of spare equipment, should exceed the maximum steaming capacity of the boilers by 10 to 20%. This margin is intended to provide against boiler swings as well as against the eventual reduction of pump capacity through wear before renewal of internal parts take place.

B.—Temperature of the feedwater and possible variations.

C.—Suction conditions, including variations in suction pressure and information on the minimum available net positive suction head. If the pump takes its suction from a direct contact feedwater heater, the net positive suctionhead (available energy over and above the vapor pressure) is the static submergence between the water level in the storage space and the pump centerline, less the friction losses in the suction piping. If, on the other hand, the pump takes its suction from the discharge of some other pump such as the condensate or a booster pump, with closed heaters located between them, the available NPSH is the difference between the suction pressure and the vapor pressure at pumping temperature, converted into feet of water at the pumping temperature.

D.—Discharge pressure preferably, but if not available, boiler pressure, since this will permit an estimate of the required discharge pressure. From past experience, it may be said that the required discharge pressure will vary from 115 to 125% of the boiler pressure. For a more accurate determination, it is necessary to know the maximum drum pressure, the static elevation of the boiler drum above the pump floor, the friction losses in the discharge piping and in the closed heaters in the pump discharge and, finally, the losses in the feedwater regulator.

E.—Chemical analysis of the feedwater, if not complete, at least with reference to its pH value. Information, if available, on the past experience with boiler feed pump materials handling the same feedwater.

F.—Type of regulation.

G.—If possible, complete layout of the feedwater system and heat balance diagram should be supplied the pump manufacturer.

Condensate Service

A.—Capacity in gallons per minute or in pounds per hour, maximum,

minimum and normal. If condensate pumps discharge through some auxiliary cooling heat exchangers such as air ejector after-condensers or oil coolers, specify the minimum flow required as this may necessitate the inclusion of automatic recirculation controls.

B.—Suction conditions, including vacuum in hotwell, minimum available submergence and expected variations.

C.—Discharge pressure: maximum, and normal. If prevailing conditions are complex, supply a system-head curve.

D.—Type of system: open or closed. In other words, does the condensate pump discharge into a direct contact heater or surge tank or does it deliver the condensate into the suction of a boiler feed pump?

E.—Type of control contemplated. Will the capacity be automatically regulated by variations in hotwell level through operation in the break, will the discharge be throttled by means of a float-regulated valve or will the float control regulate the bypassing of a certain quantity of condensate back into the condenser hotwell.

Condenser Circulation Service

A.—Rated capacity and in case of parallel operation of several or more units, desired capacity with reduced number of units in service.

B.—Rated head and in case of parallel operation of several or more units, detailed information so heads at reduced flows can be determined.

C.—Suction conditions with detailed information if conditions will result in increased capacity at reduced head operation.

D.—If pump will operate on a siphon system, will siphon be established by evacuating the entrapped air or must pump fill the siphon? If the pump must fill the siphon advise static head from suction supply to top of siphon. (Usually it is better to establish the siphon by evacuating the entrapped air.)

E.—Character of water with information as to materials of construction found suitable for existing units.

F.—Type of installation—horizontal or vertical. If latter, whether wet or dry pit with information as to local conditions.

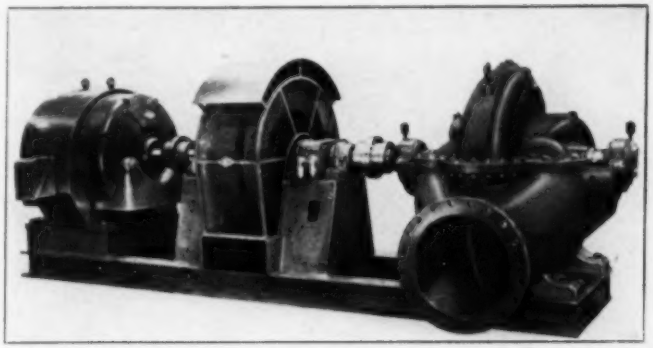


Fig. 17—Variable speed magnetic-drive unit between centrifugal pump and motor provides pump output on a sliding scale.

Industrial Water Supply

The requirements for water supply to industrial plants vary widely with small to large capacities and low to very high heads handling all types of water, fresh, salt, brackish, often contaminated with chemicals. In general the data given above under "Water Works Services" and "Condenser Circulating Service" will serve as a proper guide.

Chemical Service

A.—What is the nature of the liquid? Acid or alkaline? What is the concentration of the solution? What impurities, if any, are present in the liquid to be handled? This last item is of paramount importance, as experience has shown that presence of various impurities has a marked effect on the relative resistance to corrosion of various pump materials.

B.—Does it contain solids in suspension and are they abrasive?

C.—Pumping temperature and vapor pressure or boiling point. What is the expected, or possible, variation?

D.—Specific gravity and viscosity at pumping temperature?

E.—Capacity — maximum, minimum and normal.

F.—Discharge conditions.

G.—Suction conditions. What is method used to prime pump if there is a suction lift? Can change in pump location be made (1) to arrange for operation under submergence if suction lift impractical or (2) to reduce positive suction head if sealing the stuffing box impractical?

H.—Special stuffing box requirements such as local practice with respect to packing, sealing methods, effect of dilution by sealing fluids, etc.

I.—What is past experience with various materials or combination of materials handling this liquid? In many cases, dissimilar materials of the reservoir from which the liquid is drawn and of the pump itself set up a galvanic action which may be harmful to one or the other material. In such cases, proper isolating precautions may be necessary.

Petroleum Services

(1)—*General and Cold Oil*

A.—Nature and complete description of liquid to be handled, including specific gravity over the range of pumping temperatures.

B.—Capacity — maximum, minimum and normal.

C.—Suction conditions with special consideration to Net Positive Suction Head (NPSH).

D.—Discharge conditions.

E.—Viscosity and variations if any.

F.—Corrosive and abrasive properties of liquid.

G.—Type of service relative to pump control.

(2)—*Hot Oil*

A to G as above and, in addition:

H.—Range of pumping temperatures.

I.—Vapor pressure at pumping temperature.

J.—Correction of capacity on hot to cold operating range and resulting effect on power consumption with reference to possible driver overload.

K.—Special stuffing box requirements such as local practice with respect to mechanical seals, pressure-sealing arrangements, smothering glands, etc.

(3)—*Volatile Fractions*

(Ethanes, Propanes, Butanes, Gaso-

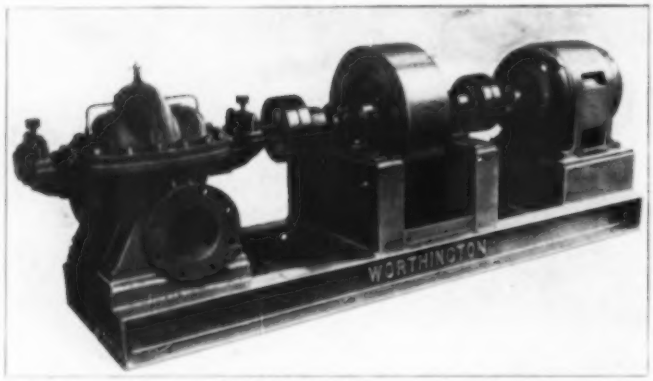


Fig. 18—Pumping unit with flywheel to keep pump operating for short interval after power is shut off. Purpose is that of moderating water hammer in case of power failure.

lines, Kerosenes, and other light fractions.)

A to G as in (1) and, in addition:

H.—Range of pumping temperatures.

I.—Vapor pressure at pumping temperatures.

J.—Special stuffing box requirements (see above).

K.—Local practice with reference to protection against fire hazards (fire-walls, special driver enclosures, etc.)

(4)—*Pipeline Service*

A to G as in (1) and, in addition:

H.—Graphical representation of required pressure gradients for entire pipeline.

I.—Possible variations in capacity or in nature of products handled.

J.—Method of operation: manual or automatic control.

K.—Special stuffing box requirements (see above).

L.—Local practice with reference to fire hazard.

M.—Local preference for series or single or multiple units.

Process and Paper Pulp Service

(Sugar, brine, brewery, food, paper stock, etc.)

A.—What is the nature of the liquid?

B.—Is it acid or alkaline?

C.—Is it clear or does it carry solids in suspension? Are these solids carried by floating or through agitation and flow? Are the solids inert or are they subject to dewatering or swelling? What is the consistency? What is the past experience in pumping this liquid with reference to the preceding questions?

D.—Pumping temperatures.

E.—Specific gravity and viscosity at pumping temperature.

F.—Capacity—maximum, minimum, and normal.

G.—Discharge conditions.

H.—Suction conditions.

I.—Are there any sanitary precautions to be observed? Any local preferences for specific details or materials of construction?

Mining Service

A.—Nature of mine water: chemical analysis, presence or absence of suspended materials, abrasive quality of the solids in suspension.

B.—Capacity requirements.

C.—Discharge pressure subdivided into static head and friction losses.

D.—Suction conditions.

E.—Location of installation: is space occupied an important factor? What are the size limitations imposed by transportation through the mine shaft?

F.—What special considerations need be given to the drivers? Is special insulation or enclosure necessary for the electric motors?

G.—What is previous experience with centrifugal pumps handling this mine water? What materials stood up best, which ones proved unsuitable?

Hydraulic Pressure Service

A.—Liquid used—water or oil?

B.—Capacity—maximum, minimum and normal. What is the rate of capacity change? Rapid fluctuations may require special precautions.

C.—Total head conditions (static head, friction losses, pressures to be maintained).

D.—Suction conditions.

E.—Type of pressure system. Does pump discharge directly to press or nozzles or does it discharge through an accumulator. A sketch of the installation is very helpful.

F.—Type of control. If an accumulator is used does it maintain a constant pressure automatically and is the pump shut down during the no-load operation or is it operated at no flow. If the latter, what arrangements are used for protecting the pump against overheating i.e., what controls the by-pass recirculation?

Ed. Note: This installment completes the three article series "Basic Factors in Preparing a Centrifugal Pump Inquiry." Although this installment also deals with pumping services outside of the Water and Sewage Works field, the authors requested inclusion of the less pertinent material in order that reprints would be useful for more general distribution to prospective pump purchasers.

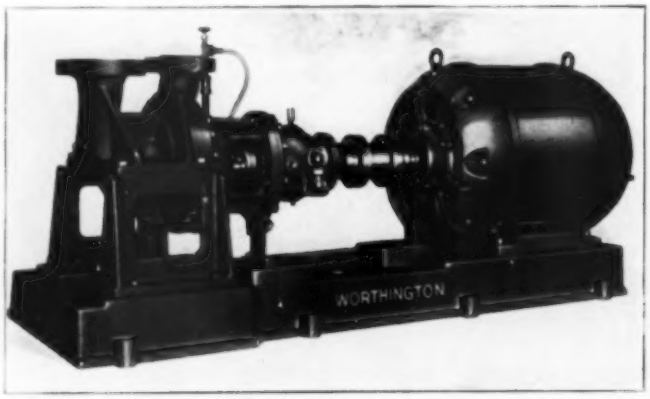


Fig. 19—A top-suction centrifugal employed in severe suction conditions, used principally in industrial processes.

Ohio Conference on Sewage and Wastes Discusses Pollution Control Law

A Report of the 26th Annual Meeting and Technical Papers Presented

by ART ROBINSON, *Director of Public Relations, Water Pollution Control Board, Ohio Dept. of Health, Columbus, Ohio*

WITH a new permit control law on sewage and industrial wastes taking effect in Ohio this year, special attention was focused on the 26th annual meeting of the Ohio Sewage and Industrial Wastes Treatment Conferences, May 21-23 in Toledo. Total registration for the meeting was over 200. In addition, visitors attending special sessions included out-of-state wastes treatment specialists representing industries which have plants in Ohio that will come under the new Ohio law.

Outgoing
Walter E. Gerdel, Supt. Southerly Sewage Treatment Plant Cleveland, Ohio

Incoming
Donald G. Stevens, Chief Technical Service Div. Std. Oil of Ohio Cleveland, Ohio

Chairmen

Law Applies to Sewage and Industrial Wastes

The opening session was largely given over to discussion of the new Ohio Water Pollution Control Act by Dr. John D. Porterfield, director of the Ohio Department of Health and chairman of the new Ohio Water Pollution Control Board, and by George Albro Hall, engineer-secretary of the Board.

Under this law, passed by the last General Assembly of Ohio in 1951, all municipalities which discharge sewage, treated or untreated, into any waters of the state, surface or underground, must obtain discharge permits from the Water Pollution Control Board prior to September 27, 1952. In these permits, the Board may specify limits on the volume and strength of such discharges. The Board also may order the installation or expansion of sewage treatment facilities. When municipalities apply for renewal of these permits, the Water Pollution Control Board will expect them to show that they have made progress toward the abatement of pollution, Dr. Porterfield said.

A similar permit control program is being set up for the discharge of industrial wastes, but before this part of the law is applied to industries, the Water Pollution Control Board is conducting a series of public hearings to determine that practical means are known for removing the polluting properties in the various types of industrial wastes. Industries are not brought under the permit section of the law until such determinations have been made. The Board plans to hold about 20 such hearings on different types of industrial wastes.

The Board has authority to institute court action to compel compliance with its regulations. Penalty provisions of the new law include fines up to $500 and imprisonment up to one year, or both, with each day of violation after conviction to be deemed a separate additional offense. The Board also is empowered to conduct programs of research, investigation and public education on water pollution.

Mr. Hall, engineer-secretary of the Board, reported on a recent survey of sewage treatment in Ohio which revealed that of the approximately 5.5 million urban population of the state, only about 1 million is now served by adequate sewage treatment facilities. About 2.5 million of the population is served by inadequate sewage treatment plants which need improvement.

Speaker
G. A. Hall, Engr.-Secy. Pollution Control Unit State Dept. Health Columbus, Ohio

The other 2 million of the urban population is entirely without sewage treatment services at this time.

It is roughly estimated that the total cost of providing adequate sewage treatment for all the urban population of Ohio will be about $300 million, and that the cost of providing needed industrial wastes treatment facilities will be in the neighborhood of $200 million. The total program of pollution abatement as visualized by the new Ohio Water Pollution Control Board, therefore, will call for expenditures totaling about a half billion dollars.

Awardee
Arthur H. Niles, Supt. Sewage Disposal Div. Toledo, Ohio (Bedell Award)

Speaker
Bruce M. McDill, Engr. Pollution Control Unit State Dept. Health Columbus, Ohio

After the discussion on the new law, Prof. Earnest Boyce, president of the Federation of Sewage and Industrial Wastes Assns., reported on Federation affairs. At a later session, he presented the A. S. Bedell Award for meritorious service to Arthur H. Niles, engineer-superintendent, Division of Sewage Disposal, Toledo.

New Officers Elected

Walter E. Gerdel, superintendent of the Southerly Sewage Treatment Plant, Cleveland, was chairman of this year's meeting. New officers elected for the coming year are:

Chairman: Donald G. Stevens, chief of technical services, Standard Oil Co. of Ohio, Cleveland.

First Vice Chairman: Waldron D. Sheets, research engineer, Ohio State Univ., Columbus.

Second Vice Chairman: Grant A. Pettit, director of industrial wastes

Programmers

Dr. John D. Porterfield, Ohio Director of Health reporting on new Water Pollution Control Act. With him are Prof. Earnest Boyce, Pres. F.S.I.W.A., and W. D. Sheets, Res. Engr., Ohio State Univ.

control, Armco Steel Corp., Middletown, Ohio.

Secretary-Treasurer: Ward E. Conrad, assistant sanitary engineer, Ohio Dept. of Health, Columbus.

Operators' Forum

A forum for operators of sewage treatment plants attracted special attention this year as a result of a survey on sewage treatment plant problems made by a committee headed by Donald D. Heffelfinger, supt. of water and sewage at Alliance, Ohio. Other members of the committee were Resler H. Calihan, asst. supt., sewage treatment plant, Dayton; W. D. Sheets, and John E. Richards, sanitary engineer, Ohio Dept. of Health, the retiring secretary-treasurer of the Conference. This committee sent a questionnaire to every plant operator in Ohio, asking each to list the major problems with which he was confronted. The three problems which headed the list were: (1) storm water; (2) industrial wastes; (3) expansion of facilities.

The question, whether increased use of detergents creates additional problems for sewage treatment plant operators, was discussed by two speakers, W. R. Gowdy, chemical division Proctor & Gamble Co., Cincinnati, and Dr. G. R. Lewis, chemical engineer, E. I. Dupont deNemours, Old Hickory, Tenn.

Mr. Gowdy described controlled tests in which it was demonstrated that foaming could occur in settling tanks only if tremendous quantities of detergents were added—quantities far beyond the likelihood of normal occurrence.

Dr. Lewis reported on an investigation of methods for the determination of synthetic surface active agents in dilute solution. Two-phase titration and turbidimetric titration were compared, with the conclusion that two-phase titration, for several reasons, appeared to be the satisfactory method to use.

Technical Papers

DETERMINATION OF THE DEGREE OF CLOGGING IN A TRICKLING FILTER, CAUSE AND EFFECT, was the title of a paper by John R. Wolfs, asst. supt., Southerly Sewage Treatment Plant, Cleveland.

Mr. Wolfs reported on problems with operation of trickling filters in a plant built in 1928, and now being modernized and expanded. The problem of clogging, he explained, was augmented by handling quantities of supernatant far above normal.

Examination of samples of stone from the filters revealed that almost to the bottom of the 10-foot beds no life existed. Some of Mr. Wolfs' conclusions: (1) That a standard rate trickling filter is an efficient unit when treating normal B.O.D. loads; (2) That large quantities of digester supernatant will quickly clog a trickling filter if settling is inadequate; (3) That high rate flows of low B.O.D. content cannot effectively be reduced in a standard rate trickling filter; (4) That the possibility of having a trickling filter clog should be seriously considered when applying flows of high suspended solid content.

EXPERIENCES WITH HEAT EXCHANGERS were reported from Cleveland by Frank S. Palocsay, principal engineer, Havens and Emerson, cons. engrs.; from Akron by George S. Long, chief supervisor of operations, Akron Sewage Treatment Plant; from Columbus by James H. Blodgett, superintendent, Sewage Treatment Plant; and from Dayton by Resler H. Calihan, asst. superintendent, Sewage Treatment Plant.

At the Cleveland Southerly Plant, scaling and deposits on coils had so reduced the efficiency of digesters that temperatures ranged as low as 66°F in winter and 77°F in summer instead of the desired 85° to 90°F. Ten external heat exchangers are now being installed to pre-heat incoming sludge to the desired optimum temperature.

Akron, within the past year, has installed eight digester heaters and heat exchangers, four of which are gas fired and four of which are combination gas and oil fired. The units were started on oil and successfully switched to digester gas. No detailed studies of efficiency have been made. Only minor troubles have been reported.

In Columbus, last year, a contract was completed which doubled sludge digester capacity. This included installation of four heat exchangers of the water jacketed tube type. Improvements in methods of temperature checking are indicated, but variables under normal operating procedure have presented difficulties in drawing definite conclusions. Tests showed efficiencies varied from 90 per cent to 12 per cent in thermal conductivity, with "no apparent rhyme nor reason for the wide divergence of the results."

Dayton, which has six 50-foot diam. digesters and four 85-foot diam. digesters with total capacity of 900,000 cu.ft. in operation since 1938, added two external heat exchangers in 1946 and two more in 1948. Experience indicated the value of installing a larger transformer than originally called for. Plant personnel also devised a gadget which duplicates the entire cycle of electrical control functions of the heat exchangers. This enables the maintenance operator to spot any irregularity in the control devices and has reduced "maintenance" and "out-of-service" time.

WATER CONSERVATION TO REDUCE POLLUTION LOAD was discussed from the viewpoint of the steel industry by G. A. Howell, asst. to the chief engr., Mfg. Div., U. S. Steel Co., Pittsburgh; of the chemical industry by John F. Vogler, san. engr., Calco Chemical Div., American Cyanamid Co., Marietta, Ohio; and of the oil industry by R. N. Simonsen, Tech. Service Div., Standard Oil Company of Ohio.

On the importance of keeping general plant and mill water clean, Mr. Howell said in some cases shock chlorination is applied to incoming

water to prevent build-up or tuberculation in the cooling facilities in order to keep the necessary amount of water circulating and to retard deposition of materials in this equipment. Also, if possible, equipment is designed so that there is very small change of velocity throughout the various pieces of equipment in order to maintain a uniform water flow and thus prevent deposits. When the water returns to its original source or treatment plant, it is in a condition where minimum treatment, if any, is required. If incoming water is dirty, and if excessive expenditures are required to clean the water, the use of recirculation should be adopted.

Mr. Vogler reported that a plant expansion program begun in late 1950 presented joint problems in water supply and in effluent quality. An extensive in-plant educational program on water conservation was undertaken with rather startling results. Despite a 27 per cent increase in production, it was found possible to reduce average daily water usage from 3.30 mgd in 1950 before the expansion to 3.01 mgd in 1951 after the expansion. This was a reduction from 45 gal. per pound of finished product to 33 gal. per pound of finished product. Even during a four-month period of extremely low flow in the Ohio River, pollution was avoided without expanding treatment facilities. The conclusion was drawn that a joint water conservation and pollution control program is practical.

Mr. Simonsen reemphasized the point that conservation can be an important means of reducing pollution. He described water usage in four different refineries. At one extreme was a refinery using water "once through" where intake supply was clean and plentiful and where dillution for discharge was adequate. At the other extreme was a plant with practically closed circuit, constantly treating and recirculating water, where intake water was so dirty as to require costly pre-treatment. The latter plant obviously had practically no waste treatment problem.

POLLUTION SURVEY OF THE MAUMEE RIVER WATERSHED, which was a joint project of the Ohio Dept. of Health, Indiana Dept. of Health and the U. S. Public Health Service, was reported by Bruce M. McDill, engineer-in-charge, Water Pollution Control Unit, Ohio Dept. of Health.

This study covered a 6586 square mile drainage area and included a study of the main tributary streams as well as of the Maumee itself.

Officers

New officers of the Ohio Sewage and Industrial Waste Conference: W. D. Sheets, First Vice Chmn.; Grant A. Pettit, Second Vice Chmn.; and Ward E. Conrad, Secretary-Treasurer.

Population of the area is 948,700 but the total pollution load has a population equivalent of 1,500,000 due to the addition of industrial wastes. In summary, it was reported that present treatment of this pollution load amounts to a reduction of about 35 per cent. Recommendation from the survey is that the majority of municipalities in the watershed should provide sewage treatment facilities for 65 per cent reduction, and that the city of Toledo provide reduction at an 85 per cent level.

TREATMENT AND RE-USE OF WATER IN BEET SUGAR MANUFACTURING by George S. Fleming, supt., Buckeye Sugar Co., Ottawa, Ohio, was a report on practical experiences in water conservation and pollution control.

Process water is re-used by the chlorination method developed by Dr. Erman A. Pearson and Clair N. Sawyer at Mass. Institute of Technology. Dr. Pearson spent some time developing the method at the Buckeye Sugar Co. The company is able to return about 75 per cent of the water to the diffusion battery without ill effects on the process. Flume water, consisting of transport water and water used in the beet washer, a large volume waste, is held in a closed circuit, re-used and recirculated so that none is discharged to the river. The flume water as it circulates in the system is chlorinated, with hourly tests to keep the residual at approximately .11 to .15 ppm in order to kill bacteria and control odors. The water next enters a receiving well with a capacity of 10,000 gal. from which it is circulated by two 3000 gpm pumps to a settling tank of 88,400 gal. capacity.

Mr. Fleming questioned theories that such a system could make great savings in sugar. He said much of the salvaged sweet stuff ends up as higher sugar content in molasses and feed for livestock—but so long as the market for these by-products holds up, the system still manages to more than pay for itself.

Other technical papers presented at the Conference included a STATUS REPORT ON WASTE PROBLEMS OF THE SYNTHETIC RUBBER INDUSTRY by Dr. R. E. Rostenbach, Plant Operations Branch Synthetic Rubber Div. R.F.C., Washington, D. C.; RECLAIM RUBBER INDUSTRY by John R. Moore, Firestone Tire & Rubber Co., Akron; METAL RECOVERY BY ION EXCHANGE by T. J. Fadgen, chief chemist and metallurgist, Ternstedt Div., General Motors Corp., Trenton, N. J.; REMOVAL OF CO_2 FROM SEWAGE GAS by James E. Frook, chemist-bacteriologist, Div. of Sewage Disposal, Toledo; TOLEDO'S IMPROVEMENT PROGRAM by Thomas B. Henry, Toledo consulting engr., and A. H. Niles, engr.-supt., Div. of Sewage Disposal, Toledo.

The meeting was concluded with tours of the Toledo Sewage Treatment Plant and of the wastes treatment works which is used jointly by Standard Oil and Pure Oil refineries at Toledo.

Happened in the Home of Coca-Cola

Voice on 'phone: "If dis am de Water Office, I wants to talk to de boss-man about mah water bill."

Water Dept. Clerk: "What is the trouble with your bill? Does it seem excessive?"

Voice on 'phone: "No ma'am hit don't seem excessive; hits jess plain too high!

(Courtesy, Atlanta Water Dep't.)

REPORT FROM ABROAD

British Views on Two Questions— How Useful is the B.O.D. Test? What of Double Filtration?

by JOHN FINCH, *Manager, Sewage Disposal Dept. Rotherham, England*

TO paraphrase—with apologies—one of the best known quotations of one of the world's greatest statesmen; never has so much been said and written about one solitary topic, as has been said and written about the B.O.D. test, the results of that test, and the Royal Commission Standard for effluents which is based on that same test.

The B.O.D. Controversy

In Great Britain, such a statement repeated, or, indeed, merely referred to in the briefest terms, at a meeting of sewage treatment plant operators and superintendents, would be calculated to immediately produce the most heated arguments involving the pros and cons, on what can only be referred to as a most controversial subject.

In Great Britain there are numbers of sewage treatment plant operators who contend that the B.O.D. determination is a very much overrated test, especially so when it is applied to any liquid in the sewage treatment plant other than the effluent. Furthermore, whereas in the U.S., reference to the B.O.D. value of raw and settled sewage is the rule, and loadings are usually referred to in terms of lbs. B.O.D., in Great Britain such references are the exception rather than the rule, only a very few works reporting in this manner.

A colleague who gave evidence before the Royal Commission, pointed out that when the Royal Commission introduced this test, it was recommended as a test for effluents, and never was intended to be used in connection with raw and settled sewages.

Another person who gave evidence stated that the B.O.D. test was designed to record the influence of final effluents on the stream into which the effluent was to be discharged, and is not suitable for use with raw sewages, etc.

Lumb, in a contribution to a symposium held in the north of England in 1947, said that he often found the 5-day B.O.D. test quoted as a measure of the strength of raw and settled sewage, whereas experience indicated that the 5-day B.O.D. of an unoxidised sewage liquor actually may have no great relation to strength and difficulty of purification. In fact, he continued, without relation to other tests a high B.O.D. does not necessarily mean high strength, but may simply mean the liquor is readily amenable to biological oxidation.

For the B.O.D. Test

D. H. A. Price in a technical discourse on the B.O.D. test which he calls "*Browsings Among B.O.D. Literature*" states that ". . . . unquestionably, the most fruitful single source of information on the subject is still the Royal Commission Reports. The work described therein is so careful and thorough that even after 35 years, it remains authoritative . . . ."

Price also goes on to say it is not clear how the idea arose that the B.O.D. test is an indication of the effect of a discharge upon a river, but is not applicable to sewage. Furthermore he points out that the Royal Commission used this test hundreds of times for sewages and trade wastes, and proceeds to explain that the designation of loading and purification in terms of B.O.D. is more rational than reference to permanganate oxygen absorbed and volumes of sewage. As an afterthought he says that the B.O.D. test also gives higher purification percentages, too.

All this, and much more, is contained in Mr. Price's most informative contribution to the literature of B.O.D., presented in the year 1948, when he was then manager of the Rochdale (Lancs) Sewage Department. I have often wondered what Mr. Price thinks of the B.O.D. test since his appointment a short time ago to the staff of the Hampshire River Board?

Against the B.O.D. Test

Feelings run very high in discussing the B.O.D. determination as a measure of the strength of raw and settled sewages. When the test is applied to sewage effluents, one finds perhaps even more pronounced views on the value of the test as used solely to classify those effluents. The participants in the debate on the subject can be said to fall into two very distinct and clearly defined camps—"nitrate" adherents and "B.O.D." fans.

It may be of significance to note that the operators proclaiming the virtues of oxidised nitrogen are invariably in charge of or interested in percolating filter schemes (there are one or two exceptions), whereas the B.O.D. followers are more often than not activated sludge supporters.

Incidentally, one of the greatest river pollution prevention, and sewage treatment authorities of his time, and one of the grandest characters in the sewage field, is an ardent supporter of the nitrated effluent theory. I refer, of course, to John H. Garner, until his retirement, Chief of the old West Riding of Yorkshire Rivers Board, and one-time Manager of the Huddersfield Sewage Department, which has one of the toughest sewage treatment problems in the world.

I well remember hearing the tale told of the man who at a meeting of sewage works operators in the late 1920's, rose to his feet and stated bluntly that the B.O.D. test had risen to a position of prominence because it showed up the performance of the activated sludge process in a favourable light and gave a better percentage purification figure than did, for example, the oxygen absorbed test. I cannot say that I entirely agree with such a theory, but I do have an activated sludge plant under my own control.

The speaker was, of course, a filter "fan" who rightly classed the nitrate content of a sample as being the hallmark of a good effluent, and a standard of purification beyond all but few activated sludge plants.

At the 1947 symposium on the B.O.D. determination, previously referred to, Dr. W. Watson, manager of the Keighley (Yorkshire) Sewage Department,

BIRMINGHAM—Percolating Filters and Final Settling Tanks under construction

made the comment that the B.O.D. test would be truly kept alive by all the re-circulation, alternating double filtration, and high rate filtration enthusiasts, because it appeared to be about the only test which really boosted these methods of purification. He further went on to say that trade waste sewages—with which he has always been connected—could be purified more or less easily to a fairly low B.O.D. figure yet such results as the 4 hours oxygen absorbed figure and the albuminoid nitrogen figure could remain high, and thus get a "black" mark from the concerned river authority. Therefore anyone with a trade waste sewage could use the B.O.D. test as a "peg to hang his hat on," and point out to the river authority that in view of the fact that the B.O.D. was quite a good figure, the effluent ought to "pass."

This is certainly a most important point as is instanced in the case of certain experimental plant at my own works, which has been used to investigate the treatment of a gas-liquor and sewage mixture. It was found that a sewage of approximately 300 ppm B.O.D. and 170 ppm oxygen absorbed could be treated to produce an effluent of 7 ppm B.O.D. but having an oxygen absorbed value of some 23 ppm. According to local river authority standards, this B.O.D. value is very satisfactory, but the oxygen absorbed value is very unsatisfactory.

Royal Commission Standards

Finally, the Royal Commission made prolonged and very comprehensive observations of the effect of polluting substances upon different rivers and correlated these with chemical analyses. They concluded that the B.O.D. determination . . . "affords on the whole a better index than any other single test of the effect which such liquors will exert on the water of the stream . . ."

Readers may be interested in the Standards for Effluents that were the order of the day in the Administrative Area of the old West Riding of Yorkshire Rivers Board. This area, of course, comprised substantially the whole of the industrial area of the West Riding where sewages were generally much stronger than in many districts in Great Britain.

STANDARDS FOR SEWAGE EFFLUENTS

A. When less than 1 ppm of nitric nitrogen is present.

The effluent is classed as:	When the oxygen absorbed from N/80 permanganate in 4 hours at 80°F is:
Good	Not more than 5 ppm
Fair	Between 5 and 10 ppm
Unsatisfactory	Between 10 and 20 ppm
Bad	More than 20 ppm

B. When 1 ppm or more of nitric nitrogen is present.

The effluent is classed as:	When the oxygen absorbed from N/80 permanganate in 4 hours at 80°F is:
Good	Not more than 10 ppm
Fair	Between 10 and 20 ppm
Unsatisfactory	Between 20 and 25 ppm
Bad	More than 25 ppm

No effluent is considered satisfactory if it contains more than 40 ppm suspended solids.

Additionally, the Royal Commission on Sewage Disposal 8th Report states: That to be satisfactory, an effluent should not contain more than 30 ppm suspended solids, and should not take up more than 20 ppm dissolved oxygen in 5 days at 65°F. Incidentally, both these standards were originally couched in terms of parts per 100,000 and not parts per million.

G. E. Beavon, Drainage Board Chairman, and J. H. Garner, President, Institute of Sewage Purification At the Birmingham Plant, 1951

Alternating Double Filtration

The report for the years of 1949-51 of the operation of the Birmingham Tame & Rea District Drainage Board (by Engineer to the Board, F. C. Vokes.) has just been issued. It is a document of considerable interest and importance. Furthermore, time may well prove it to be singularly significant in respect to the future trend of one of the most important aspects of the operation of the percolating filter—the alternating double filtration process of oxidation.

The alternating double filtration modification has been regarded by many designers and sewage treatment plant operators rather in the light of an interesting technicality and development of the "straight" percolating filter process. They have kept their feelings well in check but have expressed considerable doubt when it came to the matter of recommending the installation of such plants in proposed new schemes or in conversions of existing schemes.

The Birmingham Tame & Rea District Drainage Board, by eventually spending upwards of £400,000 on just such a conversion of a section of their existing percolating filter installation at Minworth, will have removed many doubts from the most critical minds. Technically, this is one of the most important and significant decisions that has been made in the sewage treatment field in Great Britain for a long time, coming as it does from perhaps the most prominent and notable sewage treatment and drainage authority in this country, and an authority of worldwide repute.

The Birmingham Report

It will be recalled that over the past decade or so, a tremendous amount of work on various aspects of alternating

double filtration has been carried out at the Birmingham works by the Water Pollution Research Board of the Department of Industrial & Scientific Research —a government-sponsored organization —and, without a doubt, the results of these investigations have been studied very intently and seriously by designers and sewage treatment plant operators alike. Quite obviously the writing is on the wall—alternating double filtration with all its variations has come to stay and the activated sludge process has met with perhaps its greatest challenger.

In the last review of the Birmingham Tame & Rea District Drainage Board's constructional activities, proposals were reported for improving the efficiency of the purification plant at Minworth. These works must be enlarged to deal with a greater volume of sewage which will be discharged consequent upon the construction of a new trunk sewer between Saltley and Minworth, and the eventual abandonment of the old works at Saltley, as well as the two smaller works at Ashbold and Tyburn.

As stated, with the approval of the Ministry of Health, modifications are now being made to one-sixth of the bacteria bed area, which is to be converted to working on the alternating double filtration principle, and additional humus tanks or clarifiers are also being constructed.

The next instalment of this improvement scheme consists of the provision of sixteen deep circular primary digestion tanks, 80 ft. in diameter, constructed of reinforced concrete. Initially only twelve of these tanks will be equipped with floating steel gas collectors, and until new sedimentation tanks are constructed, the remaining four circular tanks will be required for de-watering secondary sludges.

The proposals also include provision of facilities for pumping the crude sludge, digested sludge and ripe sludge for inoculation purposes, together with facilities for circulating and heating the digesting sludge. Sludge gas from a contributory population of 1,021,000 persons will be collected from the twelve tanks, the capacity of which will be 2.25 million cubic feet. The gas will be obtained from the digestion of crude sludge, storm water sludge, surplus activated sludge, and humus sludge, an estimated yield of about 300 million cubic feet per annum. The estimated cost of this proposed sludge digestion scheme will be in the region of three quarters of a million pounds sterling.

Incidentally, readers of *Water & Sewage Works* may remember that the Deputy Engineer to the Board, Mr. M. R. Vincent Daviss, presented a paper on the Birmingham design studies before your Federation of Sewage Works Assn. in 1950 and visited a number of plants.

N.P.A. Approves 935 Water & Sewage Projects in Amount of Almost $600,000,000

The Water Resources Division of the National Production Authority, G. E. Arnold, Director, has issued a detailed list of Water & Sewage Projects which were approved and received allocation of all necessary materials under the Controlled Materials Plan for the First Quarter, 1952. The following impressive list is a consolidated tabulation of projects approved by states and the estimated costs of all projects. This list becomes the more impressive when realizing that these projects represent approvals for only the first three months of 1952 and that the estimated cost totals $574,012,193 for these 935 projects.

Additional applications were not approved on grounds that "immediate necessity" could not be shown by the applicants. The consolidated list of approved projects follows.

PROJECTS APPROVED BY WATER RESOURCES DIVISION OF THE NATIONAL PRODUCTION AUTHORITY
First Quarter 1952, Controlled Materials Plan Applications
(Nov. 1, 1951-Jan. 15, 1952)

State or Territory	Number of Projects	Value of Projects: Water Projects	Value of Projects: Sewage Projects
Alabama	15	$ 1,003,278.00	$ 1,730,197.80
Arizona	7	159,217.65	111,290.00
Arkansas	11	256,052.00	274,285.83
California	140	50,555,879.71	5,198,299.60
Colorado	9	24,445,000.00	302,787.50
Connecticut	8	141,000.00	2,634,614.00
Delaware	4	—	2,495,597.43
Dist. of Columbia	6	—	2,345,047.50
Florida	27	2,823,307.76	4,524,385.00
Georgia	10	917,497.85	237,136.00
Idaho	1	138,440.00	—
Illinois	44	4,948,583.95	14,921,746.00
Indiana	16	1,794,880.00	1,326,547.00
Iowa	9	362,962.00	30,000.00
Kansas	13	395,319.00	1,113,268.00
Kentucky	9	1,175,032.00	1,843,023.00
Louisiana	17	11,422,833.00	768,330.25
Maine	3	1,314,200.00	—
Maryland	15	2,611,213.00	2,221,785.70
Massachusetts	14	3,500,423.00	7,250,000.00
Michigan	26	6,691,300.00	45,866,860.90
Minnesota	8	136,000.00	7,489,457.00
Mississippi	6	449,690.00	—
Missouri	14	1,183,994.45	12,079,028.32
Montana	1	1,390,000.00	—
Nebraska	3	1,164,350.00	—
Nevada	0	—	—
New Hampshire	4	254,628.00	312,000.00
New Jersey	23	2,905,476.00	18,045,552.41
New Mexico	4	2,040,700.00	2,000,000.00
New York	60	84,233,391.00	64,141,867.00
North Carolina	16	6,498,880.46	2,450,000.00
North Dakota	7	388,385.62	1,618,053.85
Ohio	59	19,412,898.45	17,608,476.45
Oklahoma	14	3,783,416.00	252,942.00
Oregon	15	7,308,327.00	45,000.00
Pennsylvania	41	19,560,217.50	13,465,425.00
Rhode Island	2	2,900.00	1,348,545.00
South Carolina	31	3,508,018.14	1,355,059.00
South Dakota	10	1,089,429.62	—
Tennessee	14	2,511,861.00	1,718,709.00
Texas	109	40,832,252.39	5,614,393.80
Utah	2	9,500.00	—
Vermont	2	505,500.00	142,350.00
Virginia	25	1,807,232.17	11,231,019.00
Washington	20	572,134.90	9,498,531.16
West Virginia	2	22,100.00	180,477.00
Wisconsin	27	1,720,067.90	1,771,581.00
Wyoming	1	150,000.00	—
Alaska	0	—	—
Hawaii	2	1,175,486.50	576,149.01
Puerto Rico	9	6,550,000.00	49,120.00
TOTALS	935	$315,823,256.02	$258,188,937.51

A Precision pH Meter and Its Operation

Electronic Ray Indicator Device Serves a Wide Variety of Applications

by EDWARD CHAMPAYGNE, *North American Philips Co., Inc., Mount Vernon, N.Y.*

THE modern chemist is using the pH test more and more in his investigations, and the determination of hydrogen-ion concentrations is also playing a more important role in medical and biological fields. Today there are few laboratories and industries where the need does not exist for a pH meter of extremely good accuracy for calibration purposes.

The pH meters used for routine measurements in factory production processes have to meet less stringent requirements than those destined for laboratory, research and highly accurate calibration work. Thanks to electronic engineering progress, meters of the latter type which meet extremely high requirements for reliability and accuracy are now available.

Precision pH instruments utilize the principle of the compensation circuit in a modified form. Since a definite relationship exists between potential and the pH value, the problem becomes primarily one of measuring the potential.

In the Philips pH meter, the traditional and vulnerable galvanometer has been replaced by a sensitive and inertialess electronic-ray indicator. Moreover, it is possible to connect to the instrument a second indicator in a special holder on the stand of a titrating burette, thus greatly simplifying the titration of liquids. Not only that, but the unit can be used for measuring oxidation-reduction potentials and will serve as a currentless millivoltmeter.

According to the latest information available, pH meters are finding wide use today in the following fields: steel-hardening, explosives, leather, paper, ceramics, textiles, dyes, cosmetics, rubber, preserved food, distilling, brewing, oil refining, soil testing, medicine, pharmaceuticals and biologicals. The instruments are also employed by the galvanic industries, laundries, starch plants, bakeries, suger refineries, dairy product establishments, and in water, sewage and industrial waste treatment plants.

Principles of Operation

Use of the pH meter is based on the Nernst theory which states that a relationship exists between the hydrogen-ion concentration of a solution and the electric potential of a measuring electrode immersed therein. In principle, this provides a method for determining the pH value by voltage measurement.

Various other methods can be used for making pH measurements but all have disadvantages as compared to modern potentiometer type units. For example, there is the colorimetric method. This employs chemical indicators which change color in direct relationship to the pH value of the solution to which they are added. For certain uses, colorimetric methods serve a useful purpose, but they are not satisfactory for measurements where high accuracy is desired or where the pH value of colored and turbid solutions must be determined.

In an instrument of the potentiometer type, the electrode system with which the potential of the liquid is tested consists of two parts: the reference electrode and the measuring electrode. These are mounted side by side and both are partially immersed in the liquid. The pH meter then measures the potential difference which is translatable into a true pH value. Three types of electrodes are illustrated in Fig. 4.

Electrodes are made in the form of simple compact immersion units which are instantly ready for use. The measuring electrode (pH sensitive) reacts to the pH value of the liquid, while the reference electrode serves only for comparison and has a constant potential in all liquids.

Electrode Construction

Although there are several types of reference electrodes known, the majority of modern pH meters employ the calomel unit. It is of simple construction and can be used in any acid or alkaline solution. Fig. 1 shows the construction of this electrode. There are two detachable parts, (1) the glass envelope and (2) the inner electrode. The envelope is filled with a saturated potassium chloride solution. Through an extending tube (3) which contains a small porous stone at the bottom end, the solution completes the electrolytic contact between the inner electrode and the measuring liquid in which the bottom end is immersed. The porous stone acts as a liquid bridge, it prevents inflow of the liquid or rapid outflow of the potassium chloride, yet provides free passage to the ions.

The liquid bridge can be flushed out by turning the inner electrode with respect to the envelope, thereby admitting air. When the potassium

Philips pH Meter with separate cabinet for chemical equipment

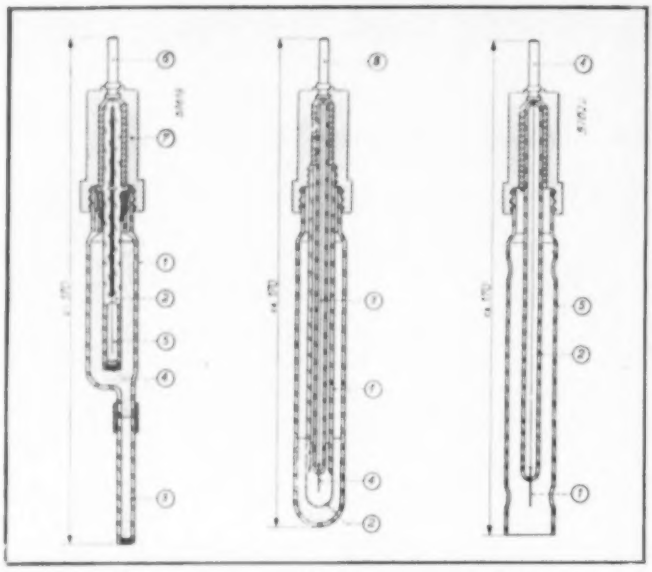


Fig. 1 Calomel Electrode | Fig. 2 Glass Electrode | Fig. 3 Quinhydrone Electrode

CONSTRUCTION DETAILS OF THREE TYPES OF ELECTRODES

chloride solution is almost depleted, the solution is easily replenished because the electrode can be removed from the envelope. The saturated potassium chloride solution is in electrolytic contact, via a second porous stone (4) also acting as liquid bridge, with the contents of the inner electrode, consisting of a paste of mercury, calomel and potassium chloride (5). From this filling an amalgamated platinum wire leads to the contact (6) located on the piece of insulating plastic with which the electrode is clamped in the holder. The illustration and dimensions apply to a very compact form of this electrode. It is possible to obtain the bottom tube (3) in other shapes to permit reduction of the dimensions of the measuring vessel and quantity of liquid. Except for occasional refilling with saturated potassium chloride solution, this type of reference electrode requires no maintenance.

Some pH meters require a number of different electrodes, each covering a different part of the pH scale. The Philips instrument utilizes a glass electrode of special construction which can be used over practically the entire pH scale. It is not affected by the liquid being tested even though the liquid varies from strongly acid to strongly alkaline. Because of this feature, it serves for practically all the pH tests and can therefore replace most other types of electrodes. Nevertheless, a quinhydrone electrode is also supplied because it is important for certain special measurements and for calibration.

Glass Electrode

Fig. 2 shows the glass electrode. It consists of a glass tube (1) which has special glass (2) fused on at the bottom. This thin-walled part permits an exchange of ions between the measuring liquid in which the electrode is immersed and the liquid filling (hydrochloric acide 0.03N). The filling liquid connects with a plug pin (5) via a lead (3) connected at the bottom with a silver-plated platinum wire (4). The advantage of this electrode is that it combines small dimensions with a reasonable mechanical strength, so that particularly careful handling is not necessary. The electrode can be used for determining the pH value of pastes, into which it can be pressed.

Maintenance on the glass electrode is limited. At times, the hydrochloric acid filling will require renewal, and it is important that the glass diaphragm does not become dry. To take care of this latter point, the electrode should be stored in the glass case filled with distilled water. The glass electrode can be used for practically all measurements between the pH values 0 and 9. To guard against adverse effects on the electrode when making lengthy measurements above pH 9, it should be immersed for the shortest possible time.

Quinhydrone Electrode

The quinhydrone electrode may be preferred for certain types of work. For calibrating this electrode can be used instead of the hydrogen electrode formerly employed for the purpose. The quinhydrone electrode is shown in Fig. 3.

The quinhydrone electrode is of simple construction. The electrode proper, which is in contact with the liquid, consists of a platinum wire (1) secured in a glass holder (2) and connected via a lead (3) to the contact (4). The glass protecting tube (5) can be unscrewed but can be kept on while the test is being made in order to protect the platinum electrode; ports have been provided for this purpose. In use, this electrode requires that a small quantity of quinhydrone be added to the solution being tested. Quinhydrone is an organic substance consisting of an equivalent mixture of quinone and hydroquinone supplied with the instrument. Immersed in a quinhydrone solution, the platinum electrode behaves as if it were surrounded by hydrogen of a certain very low pressure. This, however, sets limitations on the use of the electrode and it cannot be used in strongly oxidizing or strongly reducing solutions.

The quinhydrone electrode is actually a simplification of the hydrogen electrode which was formerly in general use and which still is used in certain laboratories for selected investigations. The hydrogen electrode utilizes a platinum plate coated with platinum black (so-called platinum sponge), and bubbles of hydrogen gas are discharged underneath the electrode so that they flow along the platinum. For practical measurements this rather cumbersome method

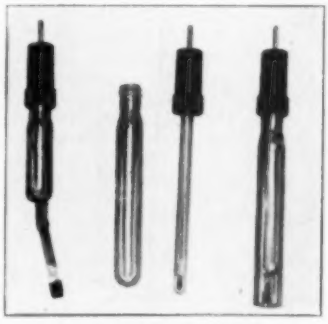


Fig. 4—Immersion Electrodes
Left to right: Calomel unit, glass electrode (disassembled into two parts), and quinhydrone unit

is no longer in favor, but it can be used with the Philips pH meter which is calibrated to give direct readings with the hydrogen electrode by setting the selector switch. The hydrogen electrode is still of importance for calibration of buffer solutions.

A buffer solution is one whose pH value is insensitive to impurities. In the case of non-buffered solutions the least impurity or additions of water or other substances causes a considerable deviation in the pH value; well-buffered solutions show this phenomenon to a much smaller degree. Moreover, a buffer solution can be made up to possess a certain predetermined pH value. For that purpose buffer solutions exhibit a sufficiently constant pH value. Tablets, to be dissolved in about 20 ml. of distilled water, are supplied for three different calibrating solutions—pH values of 3, 6 and 8.

Meter Handling and Use

Without going into details concerning proper physical set-up of the pH instrument, actual measurements require three preliminary steps:

1. Zero point adjustment
2. Calibration of the compensation voltage with the aid of the built-in standard element
3. When the glass electrode is used, compensation of asymmetry potential with a buffer solution

For pH measurements, the buffer solution is replaced by the solution to be measured, after having washed the electrodes. If a platinum electrode is being used, a small amount of quinhydrone must be added to the solution under test.

The temperature of the solution is determined and the proper setting is made on the temperature-correction knob (R_2). Now, the knobs A_2, A_3 and R_4 are adjusted until the luminescent sectors of the electronic-ray indicator (B_1) have minimum width. The pH value of the unknown solution can then be read directly by adding the values indicated by knobs, A_2, A_3 and R_4. Thus, the pH equals A_2 plus A_3 plus R_4. Fig. 5 shows position of the knobs referred to above.

Sources of Error

It is important to point out various sources of error to be guarded against when using potentiometric instruments for measuring pH values. These errors are not attributable to the instrument but rather to its operation and maintenance. Sources of error may be due to:

1. The nature of the electrode system used
2. The properties of the liquid to be measured
3. The calibration
4. The measuring equipment
5. The observer, because he is responsible for necessary precautions

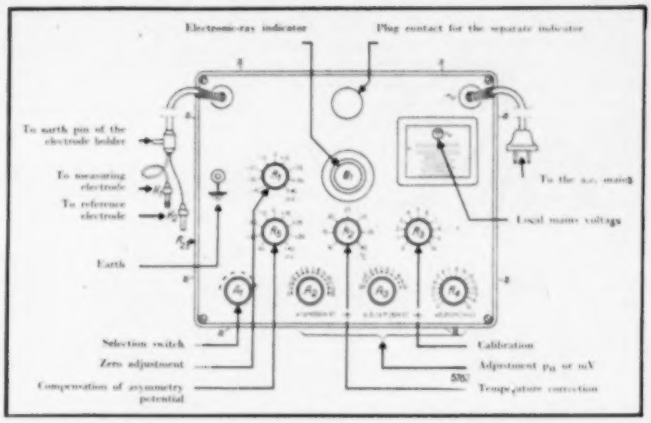


Fig. 5—Diagram illustrating connection and adjustment details of the Philips pH Meter

Modern glass electrodes with high resistance do not directly provide a fixed relation between pH and potential, because each electrode has a different asymmetry potential. This is due to the fact that, when the bulb is blown, more sodium vaporizes on the outside than on the inside because the outside is in direct contact with the flame. Moreover, the asymmetry potential may change in use, so it is necessary to calibrate the electrodes with respect to buffer solutions of known pH, which is determined by measuring with the hydrogen electrode.

Temperature Coefficient

The electrode system has a temperature coefficient. Modern pH meters have a correction knob for temperature compensation, but this corrects only for the temperature of the electrode system and not for deviations in temperature of the buffer solutions. Therefore, when calibrating, it is necessary to keep the buffer solution at exactly the correct standard temperature. Glass electrodes must never be allowed to dry, because if they do the layer of silicon oxide-gel will crack. When not in use the electrodes are kept in distilled water. If they are to remain unused for long periods of time, they should be immersed in water containing glycerol and after that preserved in cotton wool. The glycerol is hygroscopic and prevents drying of the gel. High temperatures are harmful because they cause the gel layer to shrink and crack.

Ion Effect

Glass is an ion-exchanger. Large quantities of sodium ions may change the composition of the inner liquid and thus cause errors. Non-buffered and weakly buffered solutions also lead to exchange of ions but in the reverse direction and so may easily give rise to errors. When measuring in distilled water there is a gradual change of pH. In view of these properties the electrodes must be thoroughly cleaned. The buffers used for calibration contain many alkali ions and therefore the electrode should be first washed in a weakly acid solution, then in distilled water.

Glass electrodes also have a salt error. At high pH values, the relation between pH and voltage is no longer linear. The normal glass electrode made of Corning 015 sodium-calcium glass can be used for pH values between 1 and 9, but outside this range deviations will occur. With potassium glass the influence of alkali ions is less so that for measuring pH values from 9 to 11 special electrodes of potassium glass can be used.

When measuring the pH of solutions, it must be remembered that the stem of the glass electrode contributes toward the potential. Drops of liquid on the stem may cause an error when they have a pH value different from that of the liquid into which the bulb of the electrode is placed. This may easily lead to errors, especially when titrating.

Other Sources of Error

Another important source of error is "hand effect." Owing to the system's high resistance, there is an ap-

preciable sensitivity to electrostatic action. In laboratories with wooden floors, where technicians wear rubber-soled shoes, the needle of the galvanometer may swing back and forth. When the technician operating the meter moves his feet, the needle immediately changes position. This may cause errors extending over the entire pH scale. With galvanometer-type instruments, the remedy is to screen the electrode system or the entire apparatus in a wire cage.

When using the calomel electrode errors may arise if the calomel solution is not saturated with potassium chloride. This occurs when the temperature of the liquid rises during the measurement, the temperature compensation then no longer being effective. The level of the liquid in the calomel electrode must not be below the level of the outside liquid because the latter may penetrate. This is particularly detrimental because the calomel electrode may easily be poisoned with organic substances if these should diffuse into it. The liquids to be measured must have a known and homogeneous temperature, especially if the reaction is alkaline. Ordinary stirring when titrating is adequate only if it is done intensively and is continued for a suitable period of time. Dilution of thick liquids is not permissible when determining the pH value, since this changes their pH. When titrating where it is not so much a matter of the exact pH but rather the variation of pH, diluting can be utilized. In milk and similar liquids, the electrode becomes covered with a thin layer of fat, which may produce an incorrect potential. Thorough cleaning after use is absolutely essential; an alcohol-ether mixture can be employed effectively as an electrode cleaner.

Strong acids have a drastic action upon the gel layer, thus the electrode cannot be used for measuring a pH value under 1 and for negative values. Above pH 10 lithium glasses can be used, but these are not suitable for solutions with a lower pH value because they are too readily soluble in water.

Normal glass electrodes have a life of approximately two years. They should never be kept in phosphate or borate buffers, because these liquids shorten their lifetime appreciably.

Calibration of pH meters using the asymmetry potential must be carried out with buffer solutions. The measurement of unknowns can never be more accurate than the calibration, thus of the buffer. The pH value of buffers may change, for example, as a result of crystallization of the dissolved substances on the stopper of the flask, evaporation of volatile components, contamination during use, etc. Therefore, buffers are not absolutely reliable and if there is any doubt about the results obtained it is better to check first with the hydrogen electrode on the condition of the buffer.

A slight trace of mold in the buffer is not very serious. Mold growth can be prevented by adding 0.01 per cent thymol, but this is permissible only when measuring with glass electrodes. The calomel electrode would yield entirely different results. It is extremely important that the buffer is held at the right temperature, since temperature coefficients of buffers vary greatly.

Electrical measuring devices used in pH meters should draw very little current, preferably none at all. So far as maintenance of the electronic components is concerned, this work can usually be done best by experts in the factory. A pH meter should be stored in a dry place and when it has not been used for a long time, it is best to place it in a dessicative for one night before making tests.

Most pH meters are well stabilized with respect to voltage and frequency. However, if the power supply exceeds normal permissible variations in voltage and frequency during peak load periods, the pH meter may become erratic as a result. Contacts on switches can be a source of error where the instrument is subject to strongly corrosive conditions sometimes found in chemical laboratories. By turning the switches back and forth periodically such trouble usually can be avoided. The pH meter should be grounded, but the measuring vessel must be insulated from the ground and must be kept dry on the outside.

Karl Kennison New Chief Engr. of N.Y. Water Board

Karl R. Kennison, consulting engineer of Boston, Mass., has been named Chief Engineer of the Board of Water Supply of New York City.

Mr. Kennison for a number of years was Chief Engr. of Boston's Metropolitan District Commission, being responsible for design of water and sewage facilities of the Metropolitan District. He joined the Commission in 1926 and resigned as its chief engineer late in 1950 because of political interferences. With him also went two of his principal assistants. In the interim Mr. Kennison has been conducting a consulting practice.

Mr. Kennison, a past president of the New England Water Works Assn., is a graduate of Colby College and the Mass. Institute of Technology. He also holds the honorary degree D.Sc. bestowed by Colby College. In his early work he became principal assistant to the late and widely known engineer—John R. Freeman.

Mr. Kennison is possibly best known for his work with the Boston Metropolitan District's water supply project, in connection with which he developed several unique features and novelty of design of a number of components of the important Quabbin Supply Project. He is the inventor of the widely used Kennison Nozzle for measuring flows of sewage, sludge and the like. He also had charge of the design of the Metropolitan District's new sewage treatment plants, which also embrace novel features of design and methods of disposal of sewage and sludge.

Fortunate is the N.Y. City Board of Water Supply to obtain the service of an engineer of such qualifications and background to head up its water supply undertakings.

An Opinion on Water Fluoridation from Britian

The Journal of the British Waterworks Assn. in an editorial devoted to the fluoridation of water supplies has the following to say concerning the policy and practice of fortification of water with fluorides.

"The idea that water can be used as a vehicle to do positive good to people is new and deserves the full consideration of the water supply industry.

"Water was something which ought not to harm the people who drank or otherwise used it. Now in the new era, it may be possible to use it to increase the health and happiness of the people."

Such an open statement by the B.W.A. becomes the more impressive when realizing that this association is principally representative of the privately owned water works systems of the British Isle.

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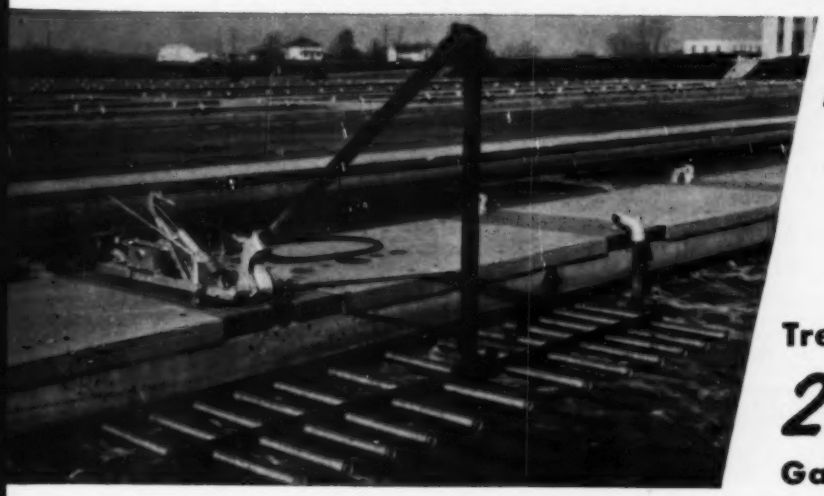

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Leading consulting and design engineers and plant operators agree that Chicago Swing Diffuser Systems offer important exclusive advantages for new plants. And, in addition, they provide a logical solution where existing aeration systems are inadequate. Here are a few reasons why . . .

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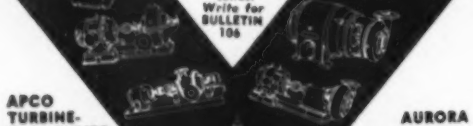

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Meetings Scheduled

Sept. 3—Lawrence, Kansas *(University of Kansas)*
KANSAS SEWAGE WORKS ASSOCIATION. Sec'y, Dwight F. Metzler, State Board of Health, Marvin Hall, Univ. of Kansas, Lawrence, Kans.

Sept. 3-5—Upper Saranac, N.Y. *(Saranac Inn)*
NEW YORK SECTION A.W.W.A. Sec'y, Rollo K. Blanchard, 50 West 50th St., New York, N.Y.

Sept. 8-10—Groton, Conn. *(Hotel Griswold)*
NEW ENGLAND WATER WORKS ASSOCIATION (Annual Meeting). Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Sept. 3-13—Chicago, Ill. *(Conrad Hilton)*
AMERICAN SOCIETY OF CIVIL ENGINEERS. (Centennial Celebration). Sec'y, Wm. N. Carey, 33 West 39th St., New York, N.Y.

Sept. 8-10—College Park, Md. *(University of Maryland)*
MARYLAND-DELAWARE WATER WORKS SCHOOL. For further information, write McLean Bingley, 2411 No. Charles St., Baltimore 18, Md.

Sept. 9-11—Grinnell, Iowa *(Grinnell College)*
IOWA SEWAGE WORKS ASSOCIATION. Sec'y, Leo Holtkamp, Box 310, Webster City, Iowa.

Sept. 10-12—Sioux Falls, S.D. *(Hotel Cataract)*
MINNESOTA SECTION A.W.W.A. Sec'y, L. N. Thompson, Water Dept., St. Paul, Minn.

Sept. 15-17—Knoxville, Tenn. *(Andrew Johnson Hotel)*
KENTUCKY-TENNESSEE SECTION A.W.W.A. Sec'y, R. P. Farrell, Dept. of Public Health, 420 6th Ave., Nashville, Tenn.

Sept. 15—Cheyenne, Wyo. *(Frontier Hotel)*
ROCKY MOUNTAIN SEWAGE WORKS ASSOCIATION. Sec'y, C. E. Harness, 272 City & County Bldg., Denver, Colo.

Sept. 16-17—Cheyenne, Wyo. *(Frontier Hotel)*
ROCKY MOUNTAIN SECTION A.W.W.A. Sec'y, Geo. J. Turre, Box 600, Denver, Colo.

Sept. 16-18—Madison, Wis. *(Hotel Loraine)*
WISCONSIN SECTION A.W.W.A. Sec'y, L. A. Smith, City Hall, Madison 3, Wis.

Sept. 17-19—Pierre, S. Dak. *(Hotel St. Charles)*
SOUTH DAKOTA WATER & SEWAGE WORKS CONFERENCE. Sec'y, Charles E. Carl, State Board of Health, Pierre, S.Dak.

Sept. 18-19—Cincinnati, Ohio *(Netherland Plaza Hotel)*
OHIO SECTION A.W.W.A. Sec'y, M. E. Druley, Dayton Power & Light Co., Wilmington, Ohio.

Sept. 21-23—Jefferson City, Mo. *(Governor Hotel)*
MISSOURI SECTION A.W.W.A. MISSOURI WATER & SEWAGE CONFERENCE. Sec'y, W. A. Kramer, State Office Bldg., Jefferson City, Mo.

Sept. 24-26—Battle Creek, Mich. *(Post Tavern)*
MICHIGAN SECTION A.W.W.A. Sec'y, T. L. Vander Velde, Dept. of Health, Lansing 4, Mich.

Sept. 24-26—Atlanta, Ga. *(Georgia Institute of Technology)*
GEORGIA WATER & SEWAGE WORKS OPERATORS' SCHOOL. Sec'y, N. M. deJarnette, Dept. of Public Health, Atlanta, Ga.

Sept. 25-27—Winnipeg, Man. *(Royal Alexandra Hotel)*
WESTERN CANADA WATER & SEWAGE CONFERENCE. (1 day Operators' School, Sept. 24). Sec'y, F. M. White, 301 Hamilton Bldg., Winnipeg, Man.

Oct. 2-3—Parkersburg, W.Va. *(Chancellor Hotel)*
WEST VIRGINIA SECTION A.W.W.A. Sec'y, H. K. Gidley, State Dept. of Health, Charleston, W.Va.

Oct. 2-4—Parkersburg, W. Va. *(Chancellor Hotel)*
WEST VIRGINIA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Act. Sec'y, Glen O. Fortney, State Dept. of Health, Charleston, W. Va.

Oct. 6-9—New York, N.Y. *(Statler Hotel)*
FEDERATION OF SEWAGE & INDUSTRIAL WASTES ASSOCIATION (Annual Meeting). Exec.-Sec'y, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill. (and) NEW YORK SEWAGE & INDUSTRIAL WASTES ASSOCIATIONS. Sec'y, Ralph C. Sweeney, 21 N. Broadway, White Plains, N.Y.

Oct. 8—Bethel, Maine
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, Winthrop Water District, Winthrop, Me.

Oct. 12-15—Tulsa, Okla. *(Mayo Hotel)*
SOUTHWEST SECTION A.W.W.A. Sec'y, L. A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

Oct. 14-17—Atlantic City, N.J. *(Chalfonte Hotel)*
PENNSYLVANIA WATER WORKS ASSOCIATION. Sec'y, W. A. Kufs, 510 Telegraph Bldg., Harrisburg, Pa.

Oct. 20-22—Pittsburgh, Pa. *(Wm. Penn Hotel)*
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA. Sec'y, William Porter, Wm. Penn Hotel, Pittsburgh 30, Pa.

Oct. 20-24—Cleveland, Ohio *(Public Auditorium)*
AMERICAN PUBLIC HEALTH ASSOCIATION. Sec'y, Mrs. W. R. Walsh, A.P.H.A., 1790 Broadway, New York, N.Y.

Oct. 21-22—Fredericton, New Brunswick *(Lord Beaverbrook Hotel)*
MARITIME BRANCH CANADIAN SECTION A.W.W.A. Sec'y, J. D. Kline, P. O. Box 574, Halifax, N.S.

Oct. 23-25—Atlantic City, N.J. *(Hotel Madison)*
NEW JERSEY SECTION A.W.W.A. Sec'y, C. B. Tygert, Box 178, Newark 1, N.J.

Oct. 23-24—Portland, Ore. *(Multnomah Hotel)*
PACIFIC NORTHWEST SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, Robert O. Sylvester, More Hall, University of Washington, Seattle 5, Wash.

Oct. 23-25—Mason City, Iowa *(Hanford Hotel)*
IOWA SECTION A.W.W.A. Sec'y, H. V. Pedersen, Municipal Bldg., Marshalltown, Iowa.

Oct. 28-31—Pasadena, Calif. *(Huntington Hotel)*
CALIFORNIA SECTION A.W.W.A. Sec'y, John C. Luthin, 1113 Laurent St., Santa Cruz, Calif.

Oct. 29-31—Washington, D.C. *(Wardman Park Hotel)*
CHESAPEAKE SECTION A.W.W.A. Sec'y, Carl L. Lauter, 6955 33rd St., Washington, D.C.

Nov. 3-5—Montebello, Quebec *(Seigniory Club)*
CANADIAN INSTITUTE OF SEWAGE & SANITATION. (Annual Meeting). Sec'y, Dr. A. E. Berry, Parliament Bldgs., Toronto, Ont.

Nov. 5-7—Old Point Comfort, Va. *(Chamberlin Hotel)*
VIRGINIA SECTION A.W.W.A. Sec'y, W. H. Shewbridge, Regional Engr., 708 State Office Bldg., Richmond, Va.

Nov. 10-12—Hendersonville, N.C. *(Hotel Skyland)*
NORTH CAROLINA SECTION A.W.W.A. Sec'y, E. C. Hubbard, State Board of Health, Raleigh, N.C.

Nov. 16-19—Pensacola, Fla. *(Hotel San Carlos)*
ALABAMA-MISSISSIPPI SECTION A.W.W.A. Sec'y, C. W. White, State Board of Health, 519 Dexter Ave., Montgomery 4, Ala. (Joint Meeting).
FLORIDA SECTION A.W.W.A. Sec'y, M. R. Boyce, 504 Pennsylvania Ave., Clearwater, Fla.

Dec. 4-6—Havana, Cuba
CUBAN SECTION A.W.W.A. Sec'y, L. H. Daniel, Baratillo 9, Havana, Cuba.

Dec. 7-10—Cleveland, Ohio *(Hotel Cleveland)*
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. (Annual Meeting). Sec'y, F. J. Van Antwerpen, 120 East 41st St., New York 17, N.Y.

Dec. 10—Winthrop, Maine
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, Winthrop Water District, Winthrop, Me.

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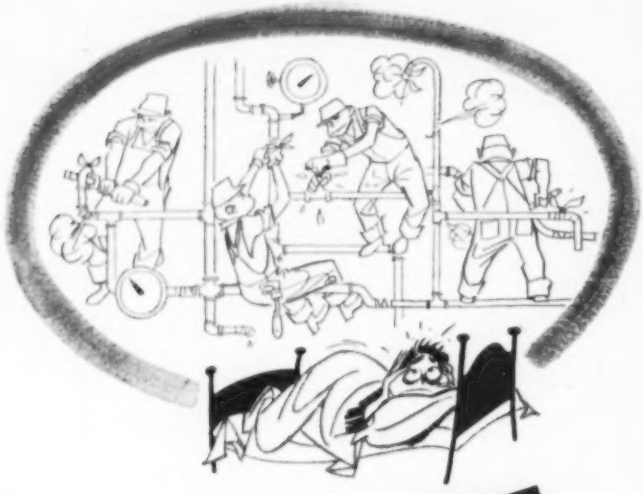

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What is Happening To Copper Supply

In our July 1952 issue, an editorial was devoted to the changed situation in copper which caused the National Production Authority to materially lift restrictions on copper and copper alloys to water and sewage works and manufacturers of valves, hydrants, meters and other equipment containing copper or copper bearing alloys. The permissible self certification of 200 pounds of copper per quarter for water and sewage works was increased in June to 750 pounds. More pronounced was the 20-fold increase permitted manufacturers—i.e., 500 pounds per quarter increased to 10,000 pounds. Larger manufacturers were notified of a 3,000 pound increase to 20,000 pounds.

What is behind this and what lies ahead is told in an article appearing in Barron's Financial Weekly for July 7, 1952. What follows has been taken from that article. It would appear that a combination of forced (strategic may be a kinder word) purchases of copper from Chile, at Chile's prices, and the sudden reduction in copper use, created by the steel strike, have jointly resulted in a backing-up of copper in the supply pipe line and the yards of copper producers. Barron's Weekly has the following to say:

"The copper situation, both at home and abroad, is confused by the fact that the so-called 'free market' has been so influenced by various Governmental controls as to almost cease to exist. At the present time, the world price ranges between 33 and 36.5 cents a pound (a fact which alone is indicative of the confusion which exists), but these prices do not actually reflect supply and demand factors.

"Demand, on the other hand, at present reflects principally complex Government actions. The most important are the stockpiling program of the U.S., Chile's export monopoly and the copper use restrictions in the U.S., Britain and Canada.

"The Government released a total of 79,000 tons of copper from its stockpile to avert a crisis in industrial supplies at the time of last year's U.S. and this year's Chilean strikes. U.S. officials are expected to rebuild the strategic hoard now that Chilean copper is again flowing to the country. Chile is now getting 36.5 cents a pound for this copper, compared with 27½ cents under the 1951-52 agreement and 24.5 cents

under our U.S. price ceiling for domestic copper. Supposedly the 36.5 cent price reflects the free world price. Actually, however, the price reflects Chile's willingness to hold copper, rather than sell it for less, and the anticipation that the U.S. will buy it anyway.

"The market weakness underlying the present range of official copper prices is fairly evident in the difficulty with which copper was traded even at 32 cents before the U.S. entered into its new agreement with Chile. Once it had agreed to the 36.5 cents for Chilean copper the British Ministry of Supply was forced to follow suit in order to secure its share of the red metal.

"Restrictions on copper use in this country, as well as in Britain and Canada, have a restraining influence on total demand for copper. Should they be relaxed permanently, demand undoubtedly would rise by quite substantial fractions. This applies especially to small manufacturers and growth companies, which are the hardest hit by NPA allocations under the comatose Controlled Materials Plan. On the other hand, large copper consumers now find increasingly that allocations based on 1950 use tend to be roughly adequate. Currently, of course, the steel strike has sharply reduced the use and purchase of copper. *Accordingly, NPA has, for its duration, suspended all restrictions on copper inventories.*

"A significant portion of trade opinion holds that copper is riding for a fall. Some traders expect the price of the red metal eventually to settle down to around 21 cents a pound.

"In the U.S., W. Jacobs, president of Phelps Dodge Copper Products Corp., expressed the view that the post emergency price level might be anywhere between 19 and 24 cents a pound.

"The immediate question of the copper situation, however, centers around how long the U.S. and Chilean governments will continue their policies of holding copper in order to maintain the price. The chances are they will do so for some time."

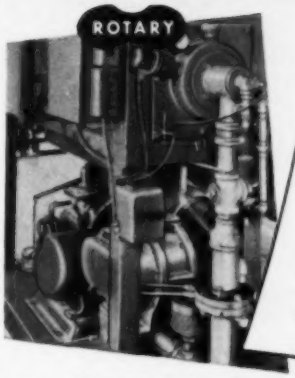
From all of this it would appear that water works would do well to buy its full quota of copper products in this period of easement of restrictions and while the 24.5 cent ceiling price still holds for U.S. produced copper.

Bulletin on Weed Control Methods for Ponds

"Weed Control in Small Ponds" is the title of a 27-page bulletin prepared by H. W. Jackson, associate biologist of the Virginia Agricultural Experiment Station. The bulletin presents clear and direct information on how to prevent the growth of all types of weeds in small ponds, or how to eliminate them if already present. It is well illustrated with photographs of the procedures described.

The practices of weed control by pond construction and fertilization, and by the use of chemicals are the principal methods discussed. In the use of chemicals, simple procedures

No more "*off the cuff*" decisions when you compare blower values



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If you are considering new equipment for handling gas or air, we suggest you examine the essential values listed above, before you make your final selection. These factors will help you determine the unit that will best match your specific application, and that will give you the most satisfactory, economical performance.

You'll find that R-C equipment rates high in every one of these essential factors. With capacities ranging from 10 cfm to 100,000 cfm or higher, at moderate pressures, and with the exclusive *dual-ability* line of Centrifugal or Rotary Positive types, you have a wide choice to meet the most exacting needs.

If you'd like to tell us about your specific problem, we'll gladly send detailed information for comparison, or supply engineering help from our 98 years of blower building experience.

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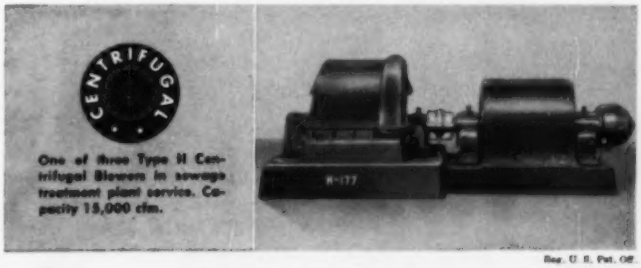

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are given for dosage calculations and the safe application of sodium arsenite, copper sulfate, and 2,4-D poisons.

Copies of "Weed Control in Small Ponds" may be obtained from Virginia Cooperative Wildlife Research Unit, Biology Department, V.P.I., Blacksburg, Va. Ask for Release No. 49-5.

Book on English and Spanish Sanitary Engineering Terms

A comprehensive translation of sanitary engineering terms from English into Spanish is available, for the first time, in a new booklet. Ing. V. J. Moya of Mexico is the author of this extremely useful work titled "Nomenclatura de Ingeneria Sanitaria" *(Sanitary Engineering Nomenclature)*. The paper bound booklet of 153 pages provides an alphabetical listing of 3,700 words, ranging from abatement (disminución, reducción, supresión) to *zymosis* (fermentacion).

The booklet was prepared, in the words of Ing. Moya, "to help spread the magnificent American research and practice in sanitary engineering and also for the furtherance of sanitation in my country.".

Only a limited edition was printed, and about one thousand copies are available. The price of the booklet is $1.00, including postage paid to the U.S. Send orders for "Nomenclatura de Ingeneria Sanitaria" to Ing. V. J. Moya, Calle del Olivo No. 30, Villa Obregon, Mexico 20, D.F.

Pickups from "Sanitary Engineering News"

Don. E. Bloodgood, Editor

SEWAGE TREATMENT WORKS COSTS
In Dollars per Capita

Population	Primary	Complete
10,000	$14	$36
25,000	12	30
50,000	10	26
100,000	9	22
200,000	8	19

For those who did not hear Prof. R. B. Hull's talk on landscaping at the December Sewage Works meeting at Indianapolis, I suggest that you request bulletins 252, 254, 320, 324 from the Dept. of Agricultural Extension here at Purdue.

One KWH can be generated from 24 cu. ft. of 600-700 B.T.U. gas.

At the Fontana, California plant of the Kaiser Steel Corporation, less than 1200 gallons of new water are used in making each ton of finished steel. The U. S. average is 65,000 gallons per ton.

If you ever have a transit or level freeze to the tripod spread the legs (the tripod, that is) until the instrument is a foot above the ground and then remove the instrument.

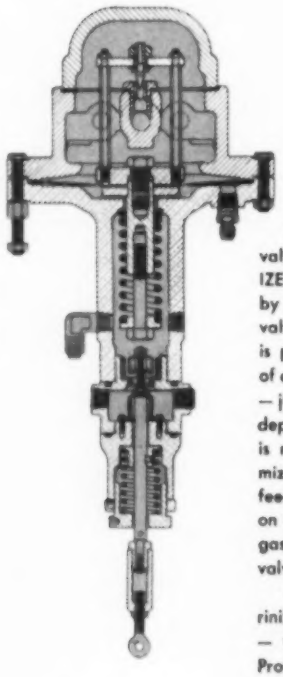
"Glucose or glutamic acid solutions (300 p.p.m.) are admirably suited for serving as standard solutions in B.O.D. work. Such solution will indicate the presence of toxic substances in the dilution water, deficiencies of nitrogen or phosphorus, and the viability of the seeding material used." —C. N. Sawyer

A possible method of producing alcohol from fruit cannery wastes, particularly pear waste, is described in Bulletin 207, published recently by the State College of Washington, Pullman, Washington.

The development and use of machine power and the gradual decline in the use of man and animal power is shown in the following table:

Year	Man Power	Animal Power	Machine Power
1850	15%	79%	6%
1900	10%	52%	38%
1930	5%	12%	83%
1960	3%	1%	96%

THERE **IS** A DIFFERENCE
IN CHLORINE GAS FEEDERS!



The difference is in the chlorine control valve. In BUILDERS Visible Flow CHLORINIZERS the flow of chlorine gas is governed by a Builders-perfected tantalum diaphragm valve. In hundreds of installations this valve is proving daily that control and metering of chlorine gas in the dry, non-corrosive state — just as it comes from the cylinder — is more dependable and more accurate. Maintenance is reduced too, because corrosion is minimized. To be sure your next chlorine gas feeder has these added advantages, insist on BUILDERS CHLORINIZERS — the chlorine gas feeders with the tantalum diaphragm valve.

For complete details on Builders Chlorinizers — the modern chlorine gas feeders — write for descriptive Bulletins. Builders-Providence, Inc. (Division of Builders Iron Foundry), 350 Harris Avenue, Providence 1, Rhode Island.

BUILDERS PROVIDENCE
Instruments

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

Meeker Retires From Worthington

Herbert J. Meeker, Assistant to Vice-President Thos. Cruthers of Worthington Corp., reached the age of retirement in July.

A 50-year veteran of the company, Meeker joined the corporation after attending Stevens Institute of Technology. He first worked at the Worthington Foundry at Elizabethport, N.J., and then became a centrifugal pump engineer in the Worthington Hydraulic Works in Brooklyn. Moving to the main plant at Harrison, N.J., when it opened in 1904, he was transferred to the Sales Department. In 1919 he was made manager of centrifugal pumps, in 1932 manager of the Public Works Division, and in 1945 assistant to Vice-Pres. Cruthers.

"Herb" Meeker, so well known to so many in the water and sewage works field, has made a host of friends for Worthington through that friendly personality underlying his engineering knowledge and buyer confidence that is bred from the technical honesty which accompanied those promotional and sales efforts in which he participated.

Portable Air Compressors

801

Ingersoll-Rand, New York, N.Y., has rounded out its line of GYRO-FLO portable compressors with three sizes in addition to its 600 cfm model.

The introduction of 315, 210, and 105 cfm units makes the advantages of the rotary sliding-vane design available for a wide range of operating re-

FLOW CONTROL NOTES FROM SIMPLEX

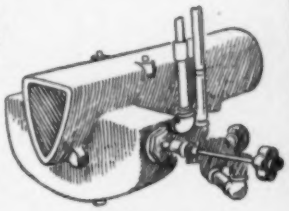
Measuring Open Flow of Raw Sewage

Problem: to measure raw sewage flowing from a 24" main, under gravity head only, and in open flow condition at outfall.

Analysis: Minimum measurable head; wide flow range...maximum to 5% of max; top flow known to be high. Measuring device to be non-clogging and self-scouring. Measurements to be transmitted several hundred yards. A venturi tube could not be used owing to low pressure conditions. Clogging tendencies of the liquid prohibited use of flow nozzles.

Solution: Simplex "S" parabolic flume and "H" meter indicated. All requirements were met by this combination...the meter could be remotely located by use of the Simplex electric transmission system.

Result: where most standard measuring devices could not be applied, "S" flume and "H" meter provide accurate measurement over long flow ranges.



"IT'S SIMPLEX—IT'S ACCURATE!"

SIMPLEX

VALVE AND METER COMPANY

SIMPLEX VALVE & METER COMPANY
6743 Upland Street
Philadelphia 42, Pennsylvania

Please send free Bulletin #401 entitled "Simplex Type 'H' Meter"

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

quirements. Major benefits claimed by the manufacturer are simplicity and low cost of operation and maintenance, and greater reliability. Smaller dimensions, greatly reduced weight, and discharge temperatures at least 100° lower than conventional portables are other important advantages.

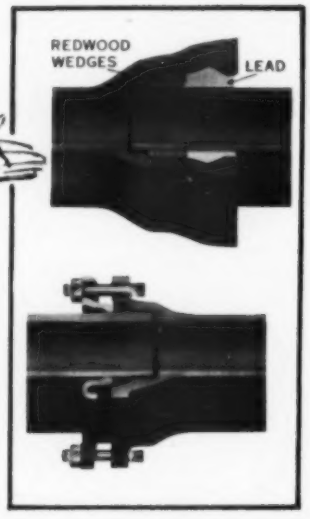
Titration and Infrared Specialists Join Beckman Instruments

Beckman Instruments, Inc., South Pasadena, Calif., has announced that Dr. Robert Austin has joined the company as a specialist in the development of titration instruments, and that Dr. William Ward has joined the company as research-staff specialist in infrared instrument design.

Dr. Robert Austin, formerly with Consolidated Engineering Corporation, Pasadena, Calif., is a native of Rexburg, Idaho, received his Bachelor's and Master's Degrees in Chemistry at the University of Utah and his Ph.D. in Inorganic Chemistry at the University of Wisconsin.

Dr. William Ward was formerly a spectroscopist with the Texas Company in its research laboratory in Beacon, New York, and spent almost half of his six years with the Texas Co. specializing in infrared research. Previous to this, Dr. Ward received his Ph.D. at Ohio State University after having completed his undergraduate work in Chemistry at St. Benedict's College.

TAKE YOUR CHOICE



TRENCH POURED

BELL & SPIGOT

Or

PRECALKED

Or BOLTITE

Select any of these three types of joint when you order McWane-Pacific Super-DeLavaud Cast Iron Pipe, 18-foot laying lengths. All three types of joint are tried and tested through years of service.

The two joints illustrated above (Precalked and Boltite) are available in all sizes of McWane-Pacific Super DeLavaud pipe. Precalked Joint has all of the joint materials (lifelong redwood wedges and pure virgin lead) placed in the bell at our foundries. All you do is "socket and calk it."

Boltite is a bolted, flexible joint, designed on the stuffing box principle. The thick gasket is compressed by the bolted gland until the joint is bottle-tight.

McWane-Pacific pipe also is available in 2-inch and 2¼-inch diameters, 18-foot laying lengths. Write or wire—

McWANE Cast Iron Pipe Company
Birmingham, Ala.
Pipe Sizes 2" thru 12"

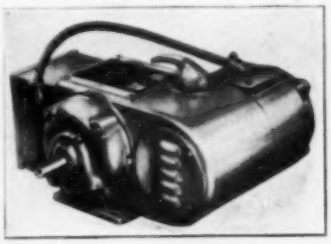
Sales Offices

Birmingham 2, Ala.	P. O. Box 2601
Chicago 1, Ill.	333 North Michigan Ave.
New York 4, N. Y.	80 Broad Street
Kansas City 6, Mo.	1006 Grand Avenue
Dallas, Texas	1501 Mercantile Bk. Bldg.

PACIFIC STATES Cast Iron Pipe Co.
Provo, Utah
Pipe Sizes 2" thru 24"

Sales Offices

Provo, Utah	P. O. Box 18
Denver 2, Colo.	1921 Blake Street
Los Angeles 48, Cal.	6399 Wilshire Blvd.
San Francisco 4, Cal.	235 Montgomery St.
Portland 4, Oreg.	501 Portland Trust Bldg.
Salt Lake City	Waterworks Equip't Co.



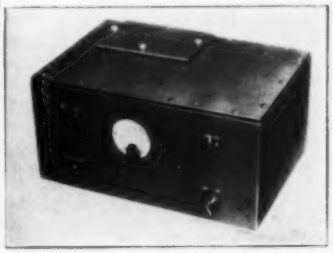
Variable Speed Motor in Fractional Horsepower

802

U.S. Electrical Motors, Los Angeles, Calif., has announced a new development in single phase variable speed motors in fractional horsepower.

As a modification of the Company's Type VA Varidrive line, the new motor permits use of 110 or 220 volts. It is designated as Type VA-C Varidrive and is made in ¼, ⅓, ½, and ¾ horsepower. This compact, lightweight motor provides speeds in a 10:1 ratio with the range from 4 to 10,000 rpm.

Merely by turning a convenient control dial, the motor's speed can be instantly changed to a desired speed without stopping. It eliminates the necessity of an external speed changing device or gear box and occupies little more room than a standard fixed speed motor.



New Flow Colorimeter

803

Beckman Instruments, Inc., South Pasadena, Calif., has developed a new Flow Colorimeter which greatly simplifies the continuous analysis and control of flowing or static streams.

Operation of the new Colorimeter is simple and fool-proof. The instrument passes light through an air path

(*Continued on page* 106A)

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

CRAFTSMANSHIP IN WATERWORKS BRASS

. . . results in uniform top quality. McDONALD Waterworks Brass is precision made from 85-5-5-5 metals with every step from foundry to final inspection and testing under rigid control. Shown above is E-4713-Stop, E-4753, E-4754 and E-4756- Copper Service Pipe Couplings.

An illustrated brochure with detailed specifications showing our complete line of Waterworks Brass will be sent to you promptly on request. A. Y. McDONALD MFG. CO., Dubuque, Iowa.

BRASS GOODS • PUMPS • OIL EQUIPMENT

EST. 1886

McDonald

(Continued from page 104A)

to a reference phototube and continuously compares the intensity of this light beam with one passing through the flowing sample to a measuring phototube. Since light to the phototubes is supplied by a single tungsten lamp, both phototubes are effected equally by variations in light intensity, thereby eliminating need for special monitoring circuits.

Meter readings can be quickly converted directly into concentration of gas or liquid in a sample . . . and by using a potentiometer-type recorder, a continuous record can be maintained of a flowing or static sample. Or, by connecting a standard recorder-controller, continuous control of the process can be maintained.

Large Expansion by U. S. Motors

U.S. Electrical Motors, Inc., Los Angeles, Calif., has announced the stepping up of its expansion in Los Angeles to adequately provide facilities for a backlog of orders. It is now operating in five separate metropolitan points, all in close proximity. The actual increase in space recently acquired amounts to an additional 40% of shop and office area.

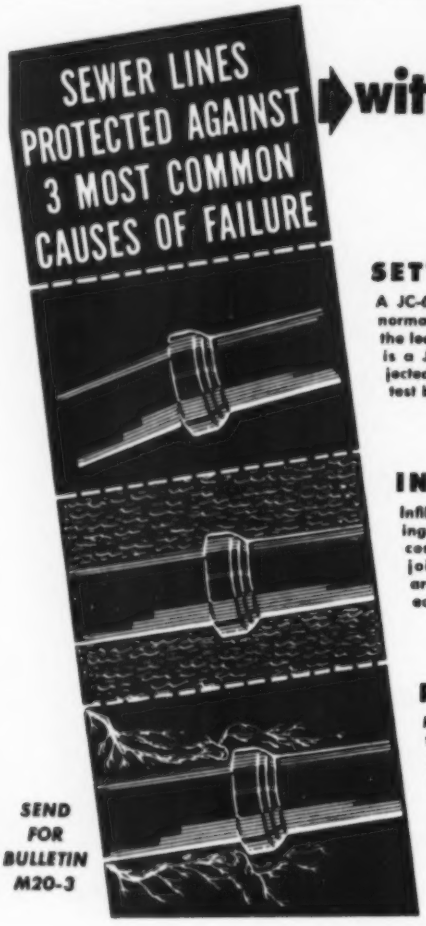
While administration headquarters remain at the principal plant, other buildings have been leased within a radius of one mile to facilitate manufacturing and servicing procedures.

One of the additional buildings is the large reinforced brick 2½ story building at 150 West Slauson Ave. which is now occupied by its Engineering and Service divisions.

With this expansion program, U.S. Motors hopes to increase production of Varidrive and Syncrogear motors and enlarge its capacity of deep well pump motors.

SEWER LINES PROTECTED AGAINST 3 MOST COMMON CAUSES OF FAILURE

ATLAS with JC-60



SETTLING

A JC-60 joint can compensate for normal settling without rupture of the leakproof seal. Pictured at left is a JC-60 joint after being subjected to a low-temperature 15° test bend.

INFILTRATION

Infiltration means greater pumping and sewage processing costs. For this reason, the tight jointing qualities of JC-60 are important in long-term economy.

ROOTS

Hardness and adhesion positively prevents roots from penetrating the compound or from entering at the interface of the sewer pipe and JC-60 joint. Root-resistance has been achieved to a degree that no other compound has equalled.

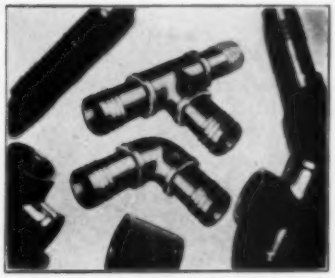
SEND FOR BULLETIN M20-3

OTHER ATLAS PIPE JOINTING MATERIALS

For Sewers: GK,® Slipjoint GK,® For Cast Iron Water Pipe: Tegul-MINERALEAD,® Hydrorings

ATLAS JOINTING COMPOUNDS ...a permanent bond

ATLAS MINERAL MERTZTOWN, PENNSYLVANIA HOUSTON, TEXAS



New Fittings for Connecting Flexible Plastic Pipe

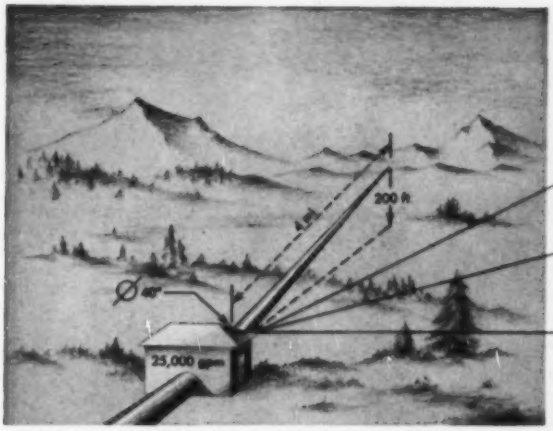
804

Carlon Products Corp., Cleveland, Ohio, has announced the development of new insert type ell and tee couplings to facilitate making sharp turns or take-offs from flexible plastic pipe lines.

These new fittings are quickly joined in the same manner as previously used for insert couplings. Sections of pipe can be cut to desired length with an ordinary hand saw and fitting inserted. Stainless steel clamps are tightened over the pipe and fitting to draw the pipe down onto the serrations of the insert to assure a positive, leakproof joint. Only tools required are saw and screwdriver, and connections can be completed in less than two minutes.

When Carlon flexible plastic pipe is to be joined to a metal fixture or a previously installed metallic system, an insert adapter is used. One end is screwed onto the metal threads, and then the plastic pipe is slipped over the serrated end and clamped securely.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.



250 feet of head

525 feet of head

975 feet of head

?

CAN YOU PICK THE CORRECT ANSWER?

● **Here is the problem:** Estimate how high total pressure head could rise from surge if power failure brought the pump in this system to an abrupt stop.

25,000 gallons per minute are being pumped up an elevation of 200 feet in a total pipeline length of 4 miles. Pumping head is 250 feet. Pipe diameter is 40 inches. A check valve is used to stop backflow through the pump.

Make your guess, then here is the answer

Total pressure head could rise as high as 975 feet. Inertia of the upward moving column of water builds up great potential energy. As the water settles back against the check valve, a succession of dangerous pressure waves occurs, often sufficient to burst the pipeline.

THE PELTON SURGE SUPPRESSOR

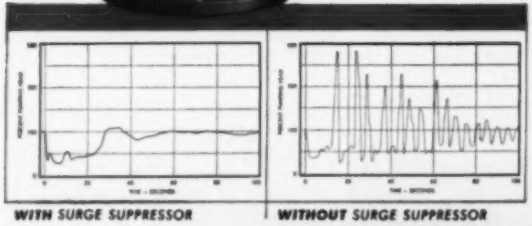
affords positive protection against this ever present danger — protection that no other valve gives.

Either current stoppage or pressure build-up actuates the **PELTON** Surge Suppressor. This quick-opening valve anticipates return surges and dissipates them by by-passing water around the pump; then it slowly closes as the pressure waves cease.

Lower pipeline costs can more than pay for a **PELTON** Surge Suppressor. Extra weight is eliminated because the pipe need not be designed with large safety factors in anticipation of high surge pressures. The possibility of line failures and interrupted service is greatly decreased.

Installations needing protection occur wherever water is pumped to a higher elevation either through a long pipeline or at high velocity. **PELTON** Surge Suppressors can be furnished to protect waterlines of any size handling service pressures up to 800 p.s.i.

Send us ***your*** *problem and include pipeline profile. Our engineers will make recommendations without obligation.*



WITH SURGE SUPPRESSOR ***WITHOUT SURGE SUPPRESSOR***

The PELTON WATER WHEEL Company

Subsidiary of Baldwin-Lima-Hamilton Corporation

2929 NINETEENTH STREET • SAN FRANCISCO 10, CALIFORNIA

Why Good Pipe Fitters Choose RIDGID 4P Geared Pipe Threader

No. 4P, 2½" to 4" pipe

Extra easy to carry and put on pipe

★ Balanced loop handles—easy to swing 4P where you want it.

★ Mistake-proof workholder sets to size *before* put on pipe—only one set screw.

★ Practically no upkeep—drive pinion in oilless bronze bearing; safe enclosed gear.

★ 4 sets of 5 high-speed steel dies for 2½", 3", 3½", 4" pipe. Ratchet handle; RIDGID Universal Drive Shaft available. Also special 4P for conduit.

★ Buy efficient 4P at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

Johnston Pump Elects Simmons President

Johnston Pump Company, Pasadena, Calif., at a recent meeting of the Board of Directors, elected Mr. Thomas W. Simmons, Jr., President and General Manager of the company.

According to Mr. Simmons, who was formerly Vice-President and General Manager, "There will be no change in our policies or plans. We will continue to develop and expand the activities of our organization, striving always to give better service and to make a better product."

Other directors of the company are Mrs. Mabel C. Simmons, Chairman of the Board; Earl Hupp, who is also Secretary-Treasurer; Charles L. Holbert, Vice-President in charge of finance; and Warren S. Pallette, General Counsel.

Liquid Levels from Distant Stations Automatically Relayed by Phone

805

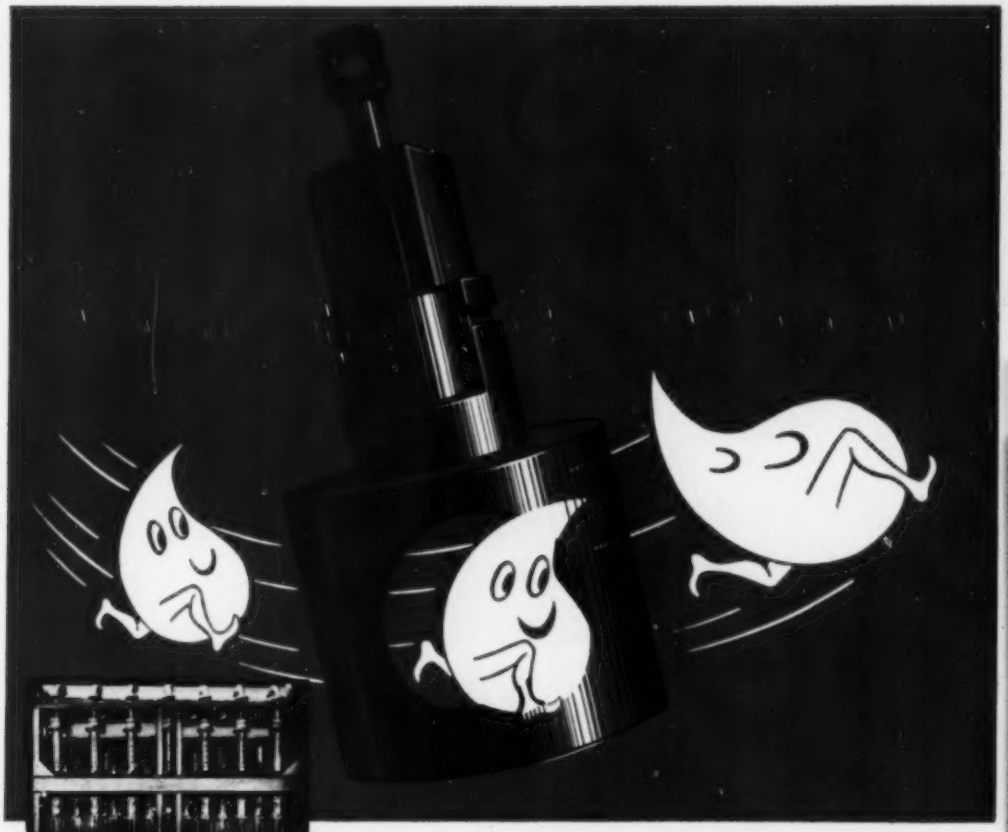
Leupold & Stevens Instruments, Inc., Portland, Ore., has developed the Stevens Telemark.

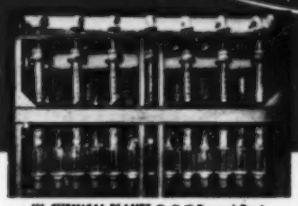
The Telemark is an accurate, versatile instrument for coding the position of moving elements and signalling this intelligence either audibly over telephone circuits, or by coded pulses for transmission by radio.

The distance of transmission is unlimited since signals can be sent over long distance telephone. Obtaining

(*Continued on page* 110A)

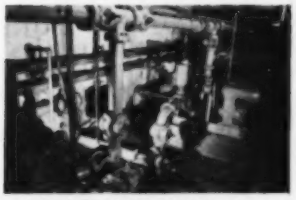
If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.





IN CHEMICAL PLANTS a.c.f. Round Port Valves provide quick emptying, full protection against corrosive action.

IN THE PETROLEUM AND GAS INDUSTRY a.c.f. Round Port Plug Valves provide full-area flow with fast shut-off.



IN SEWAGE PLANTS a.c.f. Valves offer uninterrupted flow. CYLINDRICAL plug actually shears obstructions.

100% OBSTRUCTION FREE

The passage of an a.c.f. Round Port Lubricated Plug Valve exactly conforms to the size and shape of the pipe. Ideal for capacity flow of abrasives and suspensions, these valves have the same quick, quarter-turn shut-off feature of rectangular port a.c.f. CYLINDRICAL "Full Pipe Area" Plug Valves. In addition, an a.c.f. Valve cannot wedge in its seat. Why tolerate a less efficient valve?

a.c.f. CYLINDRICAL FULL PIPE AREA PLUG VALVES

Write for Catalogue 4-W3, American Car and Foundry Co., Valve Division, 1501 E. Ferry Ave., Detroit 11, Mich.

Representatives in 50 Principal Cities

(Continued from page 108A)

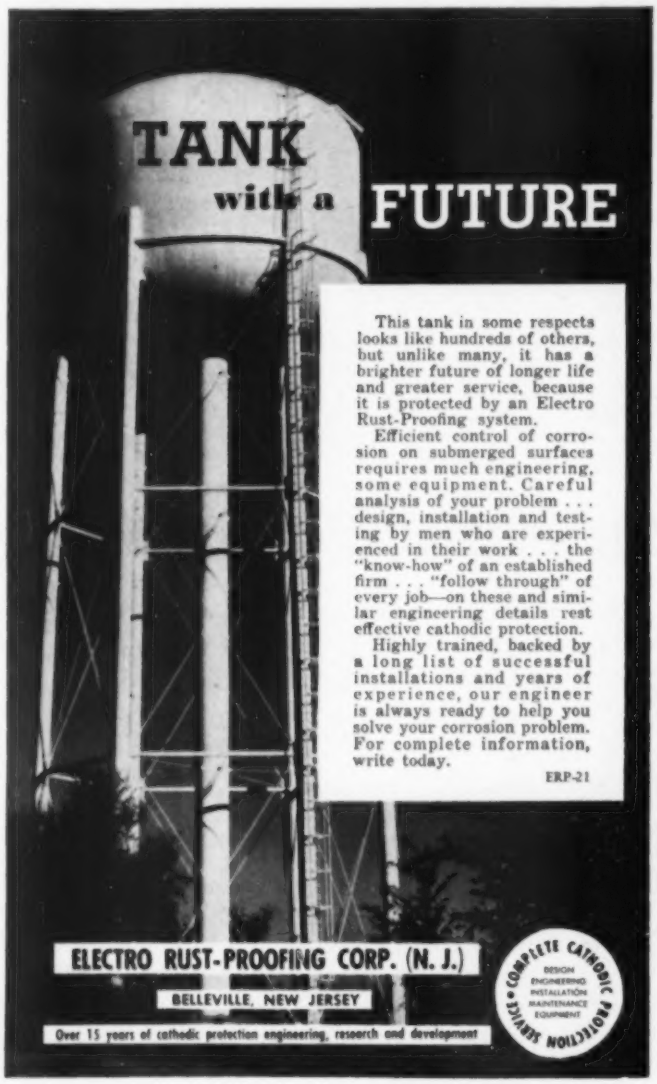
Telemark signals by telephone is as simple and easy as making a telephone call to home or office. Telemark response to a telephone ring is automatic and the instrument automatically resets itself for the next call.

The moving elements thus measured and signalled can be liquid levels in streams, reservoirs, locks, weirs, tanks or flumes, positions of gates or valves, differential manometer levels, totalizing meter dials or accumulated precipitation in a precipitation gage. Measurements may be in the English decimal or duo-decimal system, or in metric units. Telemarks for practically any ranges are available, from zero to 9999.

Johns-Manville Expands Watson, Calif. Plant

Johns-Manville Corporation, New York, N.Y., has announced a major expansion of the company's plant at Watson, California, for the production of industrial insulations.

It is expected that construction of the building to house the new operations will be completed in the early fall of 1953. The building will enclose about 100,000 square feet of floor space, and when completed, will also export industrial insulations to the Hawaiian Islands and Central and South America.


TANK
with a FUTURE
This tank in some respects looks like hundreds of others, but unlike many, it has a brighter future of longer life and greater service, because it is protected by an Electro Rust-Proofing system.
Efficient control of corrosion on submerged surfaces requires much engineering, some equipment. Careful analysis of your problem . . . design, installation and testing by men who are experienced in their work . . . the "know-how" of an established firm . . . "follow through" of every job—on these and similar engineering details rest effective cathodic protection.
Highly trained, backed by a long list of successful installations and years of experience, our engineer is always ready to help you solve your corrosion problem. For complete information, write today.
ERP-21
ELECTRO RUST-PROOFING CORP. (N. J.)
BELLEVILLE, NEW JERSEY
Over 15 years of cathodic protection engineering, research and development
COMPLETE CATHODIC PROTECTION SERVICE
DESIGN
ENGINEERING
INSTALLATION
MAINTENANCE
EQUIPMENT

Air-Operated Butterfly Valve

806

Minneapolis-Honeywell Regulator Co., Industrial Division, Philadelphia, Pa., has developed a pneumatically operated butterfly valve for control of air, water or steam flow.

The pneumatic valve motor is described as a Grad-U-Motor power unit. It is operated on a controlled air pressure range of zero to 15 psi. Adjustable mechanical stops provided on the motor enable the wing rotation to be limited for special applications.

The valve is sized from 1½ to 6 inches, with screwed connection. Body wing and trim material is bronze. Maximum operating temperature is 250°F; maximum pressure, 20 psi.

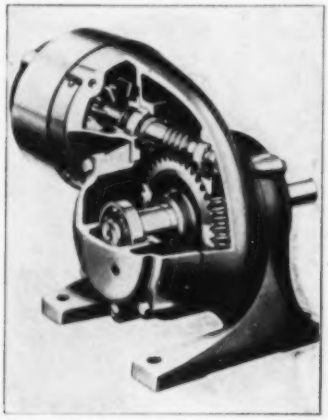
Worthington Names Ziegenhagen Advertising and Sales Promotion Manager

Worthington Corporation, Harrison, N.J., has announced the appointment of M. E. Ziegenhagen as Advertising and Sales Promotion Manager of the Corporation.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

Ziegenhagen has been associated with General Electric Corporation since his graduation from the University of North Dakota in 1937 where he was awarded a B.S. degree in Mechanical Engineering.

After taking General Electric's student engineer course, he became sales promotion assistant in that company's Pittsfield, Mass., plant. In 1941 he became account supervisor at the Schenectady plant and from 1943 to 1945 was in the service of the U.S. Navy. Since 1946 he has been in charge of advertising and sales promotion for several of the product departments of General Electric's Schenectady plant.



Right-Angle Worm-Gear Motor

U.S. Electrical Motors Inc., Los Angeles, Calif., has announced an entirely new line of low speed right-angle worm-gear motors.

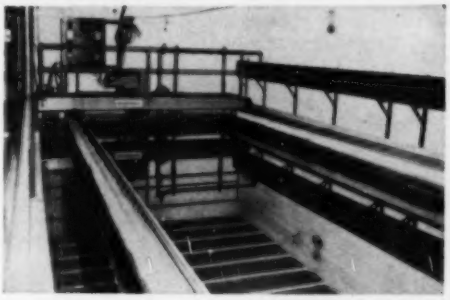
Introduced as Type GW Syncro-gear, the design presents numerous exclusive features not heretofore available in low speed motors. Type GW incorporates a cantilever design to protect gear alignment. Mounting stresses are absorbed by a rugged single unit pryamidal base with "spread eagle" feet. It embodies splash lubrication, a hardened and ground worm, leakproof oil seal and asbestos-protected windings.

The new motor is built in speed ranges from 20 to 155 rpm and gear ratios up to 58:1, horsepower ranges from ¼ to 3 and is made in both 3-phase and single phase.

W. D. Anderson Organizes Engineering Service

Wendell D. Anderson, C.E., who has traveled the Southeast for many

AUTOMATIC BACKWASH SAND FILTERS



for WATER SUPPLY

12½'x 40' Hardinge Automatic Backwash Sand Filter in a Vermont municipal water-treating plant.

for TRADE WASTES

6'x 52' Hardinge Filter handling "white water" in a Canadian paper plant. Note excessive floating waste material on influent side (left).

for SEWAGE

9'x 24' Hardinge ABW Sand Filter operating on sewage settling tank effluent at a sewage disposal plant in British Columbia.

The Hardinge Automatic Backwash Sand Filter cleans itself while filtering—no shut down or change-over is necessary during backwashing. High efficiency of filtration results. Bulletin 46-A-15.

HARDINGE COMPANY, INCORPORATED

YORK, PENNSYLVANIA—240 Arch St. Main Office and Works

NEW YORK 17 • SAN FRANCISCO 11 • CHICAGO 6 • HIBBING, MINN. • TORONTO 1

122 E. 42nd St. 24 California St. 205 W. Wacker Dr. 2016 First Ave. 200 Bay St.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

years in the interests of clay pipe sanitary engineering and consulting service, has recently organized The Sanitary Engineering Service, Inc., at 206 Connally Building, Atlanta, Georgia.

Mr. Anderson is qualified by training and experience to head the Corporation as President and Chief Engineer, and among his clients are those principal vitrified clay sewer pipe manufacturers who serve the contractors, dealers and government engineers in the growing and expanding South. Particularly, he will serve the engineering profession with sanitary construction and material data, research developments in house connection jointings, perimeter heating innovations and general information on drainage problems.

Paint for Highly Porous Masonry Surfaces

808

L. Sonneborn Sons, Inc., New York, N.Y., has developed Hydrocide Colorcoat, a new paint that primes, seals and finishes highly porous masonry surfaces in one application.

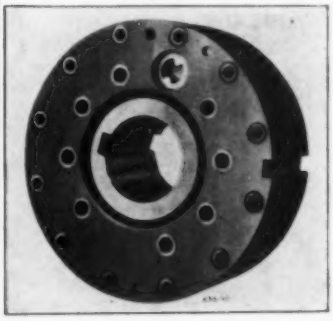
Colorcoat's specially formulated oil base paint and aggregate hides and fills in cracks and chips on old buildings or prevents them in new buildings. According to the company, it is easy to use, flows on like soft putty and can be applied by brush or spray. It is currently available in six lime proof colors.

Omega Machine Co. Promotes John Larsen

Omega Machine Co., Providence, R.I., has announced the promotion of John Larsen to Assistant Sales Manager.

Mr. Larsen became associated with Builders Iron Foundry in June, 1940. Until August, 1942, when he entered the Army Air Corps, he was assigned to numerous departments throughout the factory and office. Upon receiving his discharge from the Air Corps in 1945, Mr. Larsen's interests centered in the Omega Machine Co., where he was appointed a Sales Engineer in the Water and Sewage Department.

Recently, Mr. Larsen was promoted to Assistant Sales Manager in charge of Water and Sewage Sales.



Overload Protection With Hydrolese Coupling or Hub

809

Jeffery Manufacturing Company, Columbus, Ohio, has developed the HYDROLESE Coupling and Hub for complete and positive protection against overloads.

The Hydrolese Coupling was designed as a flexible coupling and overload release to go between the motor and speed reducer. It is designed to

(Continued on page 113A)

MH
HYDRAULICALLY OPERATED
GATE VALVES
M & H Gate Valves, Classes A, B and C, may be ordered for hydraulic operation with either cast iron brass-lined cylinders or seamless brass tube cylinders, as illustrated. A bronze tail rod is extended through the top of the cylinder cover to indicate the position of the gate, also as a pull rod to operate the valve in the event of pressure failure. An adjustable stop may be installed on the cylinder cover to control the degree of opening of the gate.
ELECTRIC OPERATION
As another means of remote control, M & H Gate Valves may be ordered equipped with electric motor operating unit for opening and closing through operation of the switch. The motor automatically stops when the valve is fully opened or closed. Valves can be operated manually in the event of power failure.
For complete information, write or wire M & H Valve and Fittings Company, Anniston, Alabama.
M&H PRODUCTS
FOR WATER WORKS • FILTER PLANTS INDUSTRY • SEWAGE DISPOSAL AND FIRE PROTECTION

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

READER SERVICE CARDS for

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These cards are to be used only for items described in THIS ISSUE

WATER & SEWAGE WORKS

Will see that you receive information desired.

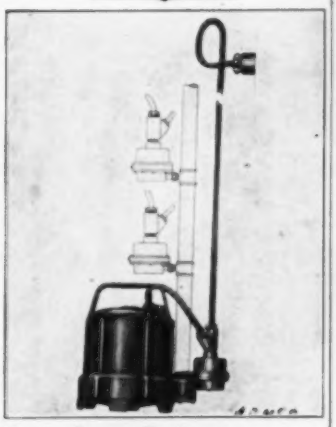
(Continued from page 112A)

carry a certain pre-determined torque load, which, when exceeded, will automatically release. It is recommended for individual drives on slow-moving conveyors using 2 hp. or smaller motors.

Where Hydrolese overload Couplings cannot be used—such applications as multiple drives from a common countershaft—the Hydrolese Hub is recommended for use on each drive sprocket. The Hydrolese Hub is a cylinder 8 inches in diameter by 4 inch face to which the drive sprocket is keyed. Like the Coupling, this device will carry a definite torque load before releasing. It is designed to slow speed applications and will carry a torque load up to 20,000 inch pounds.

E. L. Oliver, Jr., Appointed Exec. V. P. of Oliver United Filters

Oliver United Filters Inc., New York, N.Y., has announced the appointment of E. L. Oliver, Jr., to the position of Executive Vice President, a change from his recently appointed position of Vice President-Manager. As executive Vice President, he will retain the duties of Manager but will have broader administration responsibilities.



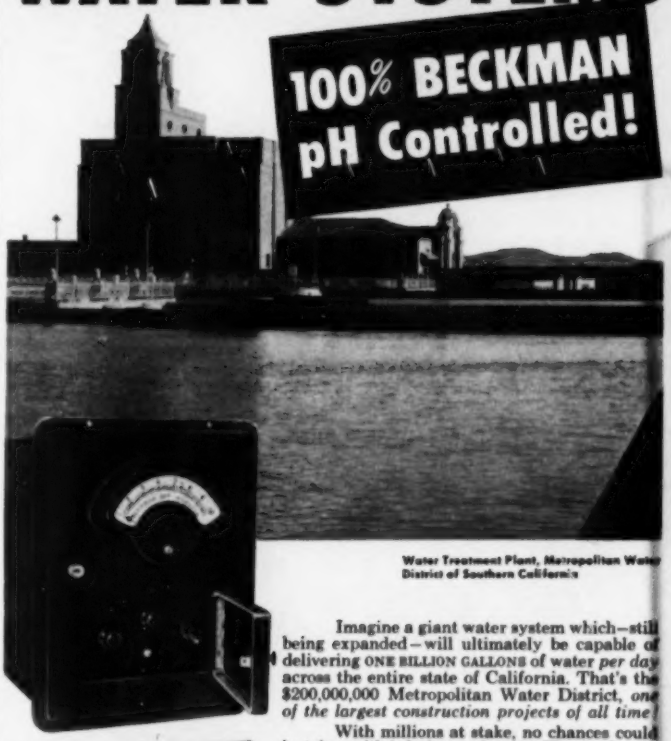
Kenco Pumps Feature Variable Turn-On Control

810

Kenco, Inc., Lorain, Ohio, has developed a sump and circulating pump with precision automatic control of water level.

With the Kenco switch and submersible Kenco pump, it is possible to set the pump to exactly suit the conditions under which it will operate. The submersible switch has no exposed electrodes or floats to corrode

One of the
WORLD'S LARGEST WATER SYSTEMS



Water Treatment Plant, Metropolitan Water District of Southern California

INSTALLED 1942—
10 YEARS' SERVICE
with negligible maintenance—typical of Beckman dependability!

Imagine a giant water system which—still being expanded—will ultimately be capable of delivering ONE BILLION GALLONS of water *per day* across the entire state of California. That's the $200,000,000 Metropolitan Water District, *one of the largest construction projects of all time!*

With millions at stake, no chances could be taken with inferior equipment. That's why the Automatic pH Control on this vast project is *100%* BECKMAN! In the giant treating plant where the water is softened and purified, BECKMAN pH Instruments control the pH of the liming process . . . the pH of the carbonation process . . . and the pH of the final treated water. *No finer tribute than this 100% installation could be paid to the unfailing dependability and outstanding quality of* BECKMAN *pH Equipment!*

What you can do with Beckman pH Control!

A Beckman Automatic pH Instrument can handle the entire pH probem in your plant. It will not only give you automatic and continuous indication of pH in your water treating operations, but it can also be equipped to give a full pH Record for future checking, and completely automatic pH Control over your processes. You can set the instrument to maintain optimum pH condition at all times thus insuring more uniform water treatment . . . eliminating "overdosing and waste of chemicals.

It operates from standard 115 v. a-c current and incorporates all the newest pH developments such as shielded and sealed maintenance-free Beckman Glass Electrodes —automatic temperature compensation—full a.c. operation (no batteries) with built-in voltage regulator. **Send for your free copy of Data File 81-20.**

BECKMAN INSTRUMENTS
Control modern industries

BECKMAN INSTRUMENTS, INC.
South Pasadena, California
Factory Service Branches: New York - Chicago - Los Angeles

BECKMAN INSTRUMENTS include: pH Meters and Electrodes - Spectrophotometers - Radioactivity Meters - Special Instruments

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INSURE YOUR FILTER
AT NO COST
by using our
FILTER SAND and GRAVEL
FOR WATER AND SEWAGE PLANTS

Close attention to detail by experienced men and new modern equipment insure both the quality and prompt shipment of all orders. Our method of shipping in bulk prevents mixing of sizes in transit.

SHIPMENT IN BAGS WHEN PREFERRED

Try us on your next order.

NORTHERN GRAVEL COMPANY
P. O. Box No. 307, Muscatine, Iowa

or stick and will operate at any practical depth.

Allied Chemical Forms New Division; Two Other Divisions Combined

Allied Chemical & Dye Corporation, New York, N.Y., has formed a new division to be known as Nitrogen Division to take over the manufacturing and related operations of the Nitrogen and Organic Sections of The Solvay Process Division and the sales of the products involved now handled by The Barrett Division and Solvay Sales Division. The sales and other personnel previously engaged in the activities to be taken over, have been transferred to the Nitrogen Division and are continuing in their former capacities.

The Solvay Sales Division and The Solvay Process Division have been consolidated under the name of the Solvay Process Division, which continues to be responsible for the production and sale of alkali, chlorine and related products. Mr. A. B. Chadwick, now President of Solvay Process, will continue in that capacity and Mr. Carlton Bates will continue as Vice President in charge of operations. Mr. H. F. Merritt, now Executive Vice President of Solvay Sales Division, will become Vice President of The Solvay Process Division in charge of sales. Mr. L. B. Gordon, now Vice President of Solvay Sales Division, will become a Vice President of The Solvay Process Division.

Priming Inductor for Centrifugal Pumps

811

Nagle Pumps, Inc., Chicago Heights, Ill., has designed the Nagle

MODERN HELLIGE INSTRUMENTS

- TURBIDITY MEASUREMENTS
- WATER ANALYSES
- pH CONTROL
- COMPLETE SOLUTION AND REAGENT SERVICE

Please Send FREE Catalog Set No. 600-W
NAME
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HELLIGE, INC. 877 STEWART AVENUE GARDEN CITY, N. Y.

FACING GRAND CIRCUS PARK

HOTEL TULLER

First thing to do in Detroit is check in at Hotel Tuller! You'll enjoy every minute. Newly modernized. Beautifully decorated. Within walking distance of all downtown stores, theatres and business activities . . . yet, you enjoy the evergreen atmosphere of Grand Circus Park . . . The Tuller Coffee Shop or Cafeteria for excellent food modestly priced.

COCKTAIL LOUNGE ONE OF DETROIT'S FINEST

800 ROOMS WITH BATH FROM $3

Harry E. Paulsen, General Manager

DETROIT

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

Priming Inductor for pumping systems where the pump is situated above the water level.

According to the company, the Inductor has rendered satisfactory performance in connection with pumps handling ashes, sand and other solids, as well as clear liquids. Basically, it is a water-operated jet, its purpose being to fill the entrance pipe and pump with liquid so as to initiate pumping.

The priming inductor is a simple unit, requiring only a clear liquid service pipe. It is coupled to the entrance pipe of the pumping unit. A service liquid supply of sufficient capacity and pressure must be piped to it, ordinary city pressure generally sufficing. No valves are needed in either the entrance or discharge pipe. Priming is completed in just a few seconds. The inductor does not retard suction after priming has been effected and it is in stand-by service.

The units are available to fit entrance pipes from 1½ to 18 inches.

Earl Elected President of United Concrete Pipe

United Concrete Pipe Corporation, Baldwin Park, Calif., has announced the election of Lloyd R. Earl, formerly Vice President of Consolidated Western Steel Corporation, as President.

Mr. Earl, a native of California, was associated with Consolidated Western Steel Corporation, or its predecessors, from 1919 to November, 1951. During this period he rose to many important operating positions and had been Vice President, Director and member of the executive committee since 1940.

High Capacity Pump Made of Hard Rubber and Neoprene

812

American Hard Rubber Co., New York, N.Y., has announced that the patented Jabsco flexible neoprene impeller pump is now available in hard rubber construction for handling acids, alkalies and other corrosives.

Though nominally only ¾ in. in size, the pump delivers 15 gpm. at 22 ft. head, or 5 gpm. at 72 ft. head. It pumps viscous or thin liquids. It is resistant to alkalies, solutions of metallic salts, inorganic acids, hydrochloric acid any strength, or any liquid that can be handled by neoprene.

The pump is self priming and will start instantly against suction lifts of 6 ft. without a foot valve. When primed, it will handle suction lifts as high as 14 ft. It can operate equally

Great News For { Swimming Pools, Sewage Systems, Water Systems }

Manzel

HYPOCHLORINATOR

Simpler • More Dependable

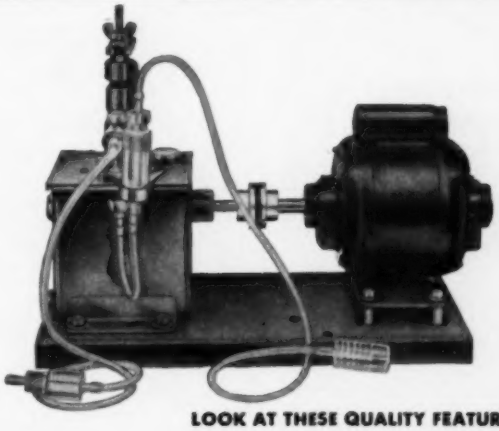
Surprisingly Low Cost

This new Hypochlorinator is backed by the name Manzel . . . famous for fifty years in the manufacture of automatic force feeding equipment. It will do everything the most expensive equipment will do . . . at a fraction of the cost. It is easy to install and simple to service. Its basic design and construction has proven itself for many years in industrial chemical feeding applications. Only Manzel "know-how" could bring such simplicity, dependability and economy to the field of hypochlorination.

CAPACITY

STANDARD UNIT — 3/8" plunger • 5.5 pts. per hour at 35 strokes per minute

SPECIAL UNIT — 1/2" plunger • 10.5 pts. per hour at 35 strokes per minute



LOOK AT THESE QUALITY FEATURES

- Full control . . . Accurate adjustments from 0 to Full Feed
- Wide range of Feed covers nearly every job
- Positive in action . . . No clogging
- Sight Feed and solution strainer
- Easily adjusted while running

See your supplier or write

Manzel

392 BABCOCK STREET, BUFFALO 10, NEW YORK

Telephone FAirview 8300

M-SCOPE Pipe Finder

LIGHTWEIGHT MODEL

One Man Operation

HIGHLY EFFICIENT

IMMEDIATE SHIPMENT

Catalog No. 256 On Request

JOSEPH G. POLLARD CO., INC.

Pipe Line Equipment

New Hyde Park **New York**

YOUR OWN SECURITY PROGRAM

Today, every plant needs security protection—to guard against dollar losses, and to prevent sabotage, thievery and accidents. Long-lasting Continental fence provides maximum safety for minimum investment. Contact nearest Continental sales office for a lifetime of protection and for your own fence "security program."

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CONTINENTAL STEEL CORPORATION
Kokomo, Indiana

Please send FREE copy of "Planned Protection"—complete manual on property protection.

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Address

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CONTINENTAL STEEL CORPORATION

well in either direction, reversing the flow.

Link-Belt Appoints Sales Managers for Philadelphia and Colmar Plants

Link-Belt Company, Chicago, Ill., has announced the appointment of James H. Oakes, former sales manager for enclosed drives, as sales manager for the Philadelphia plant, and Byron K. Hartman, former assistant sales manager at Philadelphia, as sales manager for the new Colmar plant, which will begin manufacturing operations later this year in Colmar, Pa., north of Philadelphia.

Mr. Oakes joined the Link-Belt Dodge plant in Indianapolis in 1929, after serving part-time while attending Hanover College and Purdue University. At Indianapolis and Philadelphia he took part in the development and engineering application of the Link-Belt P.I.V. variable speed drive. He has served as application engineer; divisional sales manager; and sales manager, enclosed drives.

Mr. Hartman joined the Link-Belt Philadelphia plant in 1937. He subsequently handled sanitary engineering sales in Chicago and later returned to Philadelphia to head up industrial waste and liquid treatment work. He was engineer in charge of vibrating screen sales before becoming assistant sales manager.

He is a civil engineering graduate of Brown University, and has studied mechanical engineering at Cooper Union Institute of Technology, Columbia University and University of Pennsylvania. Before joining Link-Belt he served as design engineer for the Hackensack, N.J., sewage treatment works.

New Waterproofing and Corrosion Protective Material

813

Rubber & Plastics Compound Co., Inc., New York, N.Y., has announced the addition of NERVA-CLAD to its line of waterproofing and corrosion protective materials.

Nerva-Clad is an engineered membrane built around a woven glass ply, ready for installation in one operation, and is designed for waterproofing and corrosion protection of tanks, tunnels, pipelines, structural steel, reinforced concrete, etc.

The component parts of Nerva-Clad are spun glass, synthetic rubbers and asphaltic hydrocarbons. The glass fiber is not affected in the least by moisture or mildew; acts like the

LEADITE

The Pioneer Self Caulking Material for C.I. Pipe

MORE THAN 50 YEARS PROVE IT!

• Tested and used by engineers, water works men and contractors for more than 50 years. LEADITE has proved its dependability under most every condition of water main construction . . . proved that it makes a good tight lasting joint that improves with age.

THE LEADITE COMPANY

Girard Trust Co. Bldg., Philadelphia, Pa.

No Caulking

St. Louis Turbidimeter

For measuring turbidity of water. Consists of cast aluminum housing, adjustable lamp . . . two vertical wells for holding two Nessler tubes.

This apparatus comes ready to plug into 115 volt line, comes fully equipped for normal operation.

WRITE:

Phipps & Bird, Inc.

P. O. Box 2V Richmond 5, Va.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

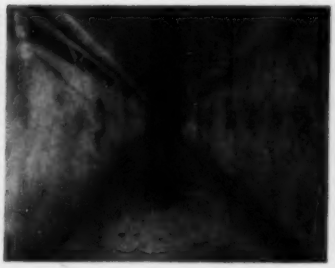
HAZE CHEMISTRY IS MAKING MONEY

Seven Electric Generating Plants measure Calcium . . . in 0 to 0.5 PPM range . . . on high pressure boiler feed Waters • Distilleries measure Clarity of filtrate, saving 70% in filtering costs. One distiller reports ". . . saved cost of your Nepho-Colorimeter FIRST day we had it." • Positive readings of Sulfur in Coke and Water . . . guarantee uniform production in 5 plants.

• Calcium and Sulfur in urine are measured in 15 minutes . . . instead of days. • Bio-chemists measure bacterial growths fast . . . detect growth of micro-organisms in sterilized serum in minutes. • All A.S.T.M. and A.P.H.A. Turbidity Readings are made WITHOUT repeated preparation of A.P.H.A. Standards.

Why don't you investigate . . . write for WACO CATALYST and HAZE CHEMISTRY Bulletins. • This NEW Nephelometry is MAKING MONEY IN MANY DIVERSIFIED FIELDS. . . .

Wilkens-Anderson Company
4525 W. Division St., Chicago 51, Ill.



Old Sewer Gets New Life with "GUNITE"

The picture at the left shows an old concrete storm sewer in Washington, D. C., badly disintegrated and honeycombed. Flow value was low due to roughness. This sewer was reconditioned by chipping away the worst areas, sandblasting the entire surface and applying a "GUNITE" lining.

The smooth brush finish increased its capacity sufficiently to meet all requirements, making it unnecessary to build a new sewer. The completed job is shown at the right.

Many money saving applications of "GUNITE" are described in our illustrated Bulletin C2400. Request on your letterhead will bring you a copy.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA. U.S.A.
MANUFACTURERS OF THE CEMENT GUN

DEPENDABILITY.....

PROVED by LOW COST MAINTENANCE

Hundreds of installations giving many years service without replacement of parts proves the simple, rugged construction which has established the reputation of the BLACKBURN - SMITH PNEUMATIC SEWAGE EJECTOR for dependability under all conditions.

Capacities from 30 to 600 GPM in single or twin units.

Pump sewage 150 feet STRAIGHT UP once a minute without fail!

The BLACKBURN - SMITH EJECTOR has no screens to clog —no impellers to jam—no water-sealed compressors . . .

Representatives Wanted

THE BLACKBURN-SMITH MFG. CO., INC
92 River St. • Hoboken, N.J.

reinforcing bars in concrete structure and provides high tensile strength and dimensional stability to the membrane; in turn, the plies of synthetic rubber compound in which the fiber glass is embedded, provide an impermeable barrier, even under hydrostatic pressure.

Yeomans Names Breckenridge Controller

Yeomans Brother Company, Chicago, Ill., has announced the appointment of C. M. Breckenridge, recently associated with Harris, Kerr, Forster & Co., as Controller.

Mr. Breckenridge is a graduate of the University of Illinois and the Walton School of Commerce. He was formerly Assistant to the treasurer of Victor Mfg. & Gasket Co., Chicago; and for several years operated his own accounting, consulting and finance business in Minnesota.

Graver Promotes Fosnot and Limon

Graver Water Conditioning Company, New York, N.Y., has announced the appointment of Harold R. Fosnot as Assistant General Sales Manager, and Leonard Limon as

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

The practical, economical answer to your underdrain problems

LEOPOLD

Glazed Tile

FILTER BOTTOMS

Successfully serving over 200 PLANTS with a daily capacity of over THREE-QUARTER BILLION GALLONS!

The Leopold Duplex Filter Bottom is made up of individual blocks, each weighing about 100 pounds, which are firmly joined together to provide a strong bed that is not disturbed by wash water. With this efficient, enduring system, you're assured an equal collection of filtered water with extremely low loss of head. There is no possible corrosion or tuberculation anywhere in the filter bottom.

Made of deaired fire clay—vitrified and salt glazed, the highly efficient Leopold Filter Bottom requires only shallow depth of small sized filter gravel and is acid and alkali resistant. Adaptable to any rectangular filter unit, it won't absorb any detrimental amount of water—and it's permanent.

Complete Water Purification and Sewage Plant Equipment . . .

- DRY CHEMICAL FEEDERS
- FILTER OPERATING TABLES
- MIXING EQUIPMENT

Write for details

F. B. Leopold Co., Inc.
2413 W. Carson Street
Pittsburgh 4, Pa.

Manager, Sales Engineering Department.

Mr. Fosnot holds the degrees of B.S.M.E. from Purdue University and M.B.A. from the University of Chicago. He came to Graver in 1935, and after training in the Graver shops was employed as District Manager until World War II.

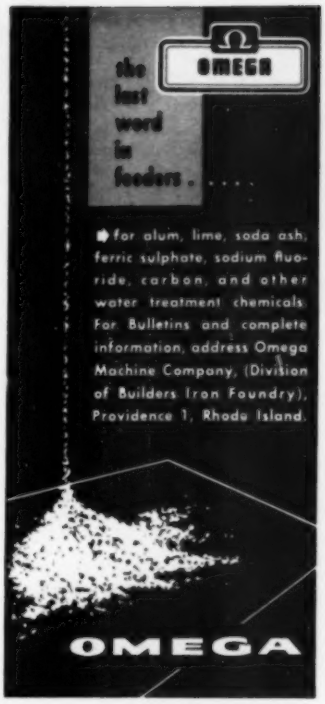
Upon his release from the Army, as a Lt. Col., Mr. Fosnot returned to the Graver Chicago office, where he continued as District Manager of water conditioning sales until 1951. He was then made Eastern District Sales Manager, and held that position until his latest promotion.

Mr. Limon holds the degrees of B.Ch.E. from City College of New York and M.Ch.E. from New York University. Before coming to Graver in 1949, he had many years of experience as executive in charge of the design, estimating and pricing of all types of water conditioning equipment, and will continue along this line in his new position.

New Line of Chromate Anti-Rust Paints

814

Chem Industrial Co., Brooklyn, Ohio, has announced a new line of


Ω OMEGA
the last word in feeders . . . .
for alum, lime, soda ash, ferric sulphate, sodium fluoride, carbon, and other water treatment chemicals. For Bulletins and complete information, address Omega Machine Company, (Division of Builders Iron Foundry), Providence 1, Rhode Island.
OMEGA

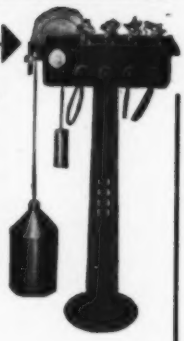
pH, Color, Manganese, Total Iron, Ammonia, Chlorine, Nitrite N, Nitrate N, Fluoride, Copper . . . all can be easily and quickly determined when you have a complete Taylor Water Analyzer Kit available in your plant. Each determination is made with separate slide. There's no handling of fragile, single standards since each slide houses a complete series of color standards. And . . . all Taylor Liquid Color Standards carry an *unlimited guarantee against fading.*

Truly, the complete kit gives you a "laboratory-in-a-carrying-case", for it contains a base, slides, all reagents and accessories. It is light weight and easy to carry, thus available for immediate use wherever you are. SEE YOUR DEALER TODAY.

WRITE FOR FREE HANDBOOK

Illustrating and describing all Taylor sets and uses for pH and chlorine control in 34 basic industries.

W. A. TAYLOR AND CO.
7308 YORK RD. • BALTIMORE 4, MD.



Installations of *Roto-Trol 940* are in constant operation in all parts of the country. In each plant, they are controlling pumps, valves, and/or alarm circuits, etc., from one float. Many installations have several starting and stopping positions, both rising and falling. Each circuit is independent. Mercury switches with snap action are used. *940* can be set on the job.

Write for Bulletin

Water Level Controls Division

HEALY-RUFF COMPANY
783 Hampden Ave. St. Paul 4, Minn.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

Just a hammer and a knife . . . and you're in business. Nail flexible, polyvinyl Labyrinth Waterstop to the wall—inside your form—and forget about water seepage between concrete pours. Here's a real time, trouble and money saver.

- *No Special Forms needed since no ties protrude into new pour.*
- *No Metal Fins to tear or bend out of place.*
- *No Welding or Vulcanizing expense. A hot knife joins sections in two or three minutes.*
- *No Maintenance. Polyvinyl lasts indefinitely, resists temperature changes and chemical action of concrete.*
- *For further information—clip coupon!*

Labyrinth Waterstop
The first really satisfactory water seal—eliminates seepage problems, simplifies form work.

WATER SEALS, INC.
400 W. Madison Street
Chicago 6, Illinois

WATER SEALS, INC.
400 W. Madison Street
Chicago 6, Illinois
Please send further information on LABYRINTH WATERSTOPS

Name_____
Company_____
Address_____
City_____ Zone_____ State_____

chromate anti-rust paints to be marketed under the trade name "Overust."

These new paints feature a high quality Menhaden Vegetable Oil base with special chromate pigments added to give extra protection against rust, the manufacturer states. They are reputed to provide a much greater degree of protection against rust than previously available protective coatings.

Available in red, gray, green, black, aluminum and clear, the new Overust chromate paints are recommended for use on any kind of metal, interior or exterior. According to the manufacturer, these paints can be applied directly over rusted surfaces without wire brushing or sandblasting, and one coat is sufficient to prime, penetrate and seal all metal surfaces.

Universal Concrete Pipe Opens New Plant

Universal Concrete Pipe Co., Columbus, Ohio, has opened a plant at Jessups, Md., 12 miles southwest of Baltimore.

Complete equipment for producing 6 to 72 inch pipe has been sent from Universal's machinery division at Columbus, Ohio. A casting yard has been

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

ROBERTS FILTER MFG. CO.
607 Columbia Ave.
Darby, Pa.

Specify IOWA!

for...

Gate Valves	Fire Hydrants
Tapping Sleeves and Valves	Mud Valves
Check Valves	Flap Valves
Indicator Post Valves	Hydrostatic Relief Valves
Square Bottom Valves	Sluice Gates
Hydraulic Valves Motor Operated	Floor Stands
Sheer Gates	Valve Accessories

SINCE IOWA 1909

We manufacture complete equipment for water and sewage flow control in Filtration Plants, Sewage Disposal Plants and Pumping Stations. Specify Iowa and let us solve your problems.

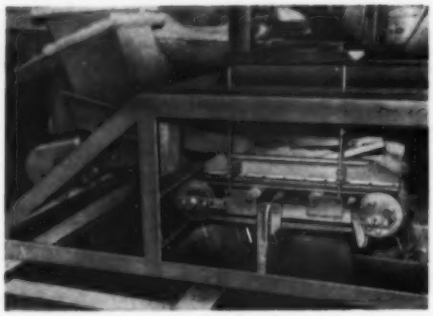
IOWA VALVE COMPANY

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

SYNTRON

"Weigh-Flow"

Gravimetric Feeders



provide
Accurate Control
in the
Continuous Feeding
of **Bulk Materials**
at a **Constant Weight**

Smooth out those "Surges" in your Production Chart

If you require accurate ingredient control and your process is a continuous one — Syntron Gravimetric Feeders will provide that control, automatically.

The combination of a scale-mounted, constant-speed belt — with the Feeders operation regulated by the overweight and underweight movement of the scale — maintains the desired weigh flow of material per unit of time.

Small models for handling up to hundreds of tons per hour.

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SYNTRON COMPANY
650 Lexington Avenue Homer City, Penna.

established on the 13-acre site for making larger diameter and long-length pipe.

In addition to round sewer and culvert pipe, the Jessups plant will handle flat-base pipe for pedestrian and cattle passes, special pipe for utility galleries and manholes, reinforced concrete river weights and open and closed-face concrete cribbing.

Beckman Insts. Moves Chicago Branch

Beckman Instruments, Inc., South Pasadena, Calif., has announced the removal of the Chicago Factory Branch to a new location at 7145 West Belmont Avenue, Chicago 34, Illinois.

The Beckman Chicago Branch maintains complete factory service facilities for all Beckman Instruments and is under the direction of Mr. George Kincaid.

Worthington Names Kansas City and Milwaukee Branch Managers

Worthington Corporation, Harrison, N.J., has appointed Paul J. Foley manager of its Kansas City office and

WILKINSON LINE LOCATOR

The original—the pace setter

Built to QUALITY strict standards

Choice of discriminating buyers everywhere

Buy Satisfaction —not 'first cost'

Get the facts first

Locates all parts of your underground system

WILKINSON PRODUCTS CO.
3987 Chevy Chase Drive
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HOMOGENIZED
BOND-O
JOINTING COMPOUND

Machine Blended to Insure Utmost Uniformity

BOND-O's exclusive machine blending process brings you the one flawless self-caulking jointing compound. The finest basic materials obtainable are so thoroughly blended by the BOND-O process—that you are assured of absolute uniformity of performance from every bag you buy.

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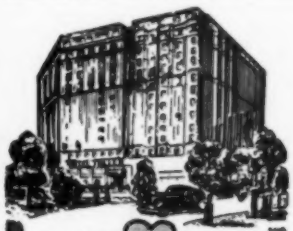

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William M. Fine manager of its Milwaukee branch office.

A graduate of Northeastern University, Mr. Foley joined the Worthington organization in 1937 after completing the Worthington Student Training Course. He then became a sales engineer in the company's Chicago office and later was made manager of its Milwaukee branch office.

Mr. Foley succeeds W. R. Kennedy, who has been named a consultant to his successor.

Mr. Fine was graduated from Lehigh University in 1939 with a B.S. degree in industrial engineering. He then took the Worthington Student Training Course and became an estimating engineer in the company's Chicago office. In 1943 he joined the sales force in that office.

Rubber Lining Development Prevents Failures in Pipe Bends

815

La Favorite Rubber Manufacturing Company, Paterson, N.J., has announced a new development for lining and covering pipe with rubber.

With this new development special designs of bent pipe and shapes can be lined with rubber without risk of processing failure. It is claimed the improved application process makes it possible to apply lining on three 90° bends in a single length of pipe as small as 4 inches in diameter. It is also possible to line any pipe size from 1½ inches in diameter up to any transportable size.

Literature & Catalogs

Armored Flowrator Flow Meter

816

Fischer & Porter Company, Hatboro, Pennsylvania, has published a new catalog that describes **Armored Flowrator Flow Meter for High Pressure Flow Rate Measurement.**

The catalog states that these variable-area flow meters with newly developed, precise, economical, tapered metal metering tubes are designed for both high temperature and high pressure and for use where liquid hammer and hazardous fluids make ordinary meters impractical or dangerous.

Besides containing complete data on many types of Armored Flowrator Meters, this new catalog devotes an entire section to meter extensions and extension combina-

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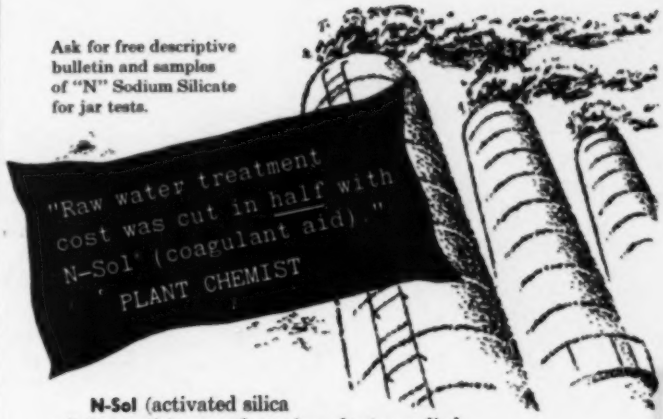

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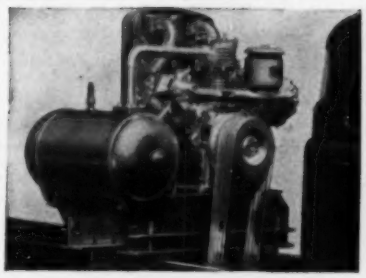

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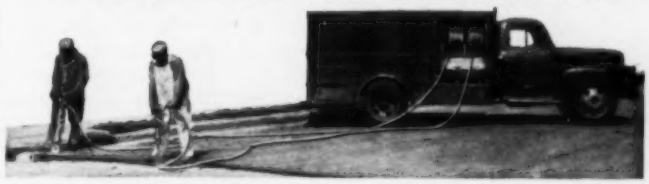

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tions which are available to armored meter user.

Cushioned Altitude Control Valves

817

Golden Anderson Valve Specialty Co., Pittsburgh, Pa., has just published a 16-page bulletin fully describing the company's **Cushioned Altitude Control Valves.**

Featured in this catalog are illustrations, operating sequence and installation arrangements of the various single and double acting altitude control valves. General instructions, parts lists and dimensions are shown, along with a special section on maintenance.

Permutit Gravity Filters

818

Permutit Company, New York, N.Y., has just published a 24-page booklet on **Permutit Gravity Filters.**

Designed to be of interest to all engineers dealing with water problems, it shows the complete line of filters and filter accessories manufactured by the company.

Specifications, blueprints, operating characteristics, outline dimensions and typical installation photographs have been included in this new edition.

Steel Water Lines in 1951

819

Dresser Manufacturing Division, Bradford, Pa., has just released its fifth annual report of water lines entitled, **"A Report of Dresser-Coupled Steel Water Lines in the Year 1951."**

This attractive, 12-page, illustrated report carries construction details on principal steel water lines laid during the past year. Waterworks engineers and contractors interested in latest developments in waterline construction methods and materials will find this report of value.

Horizontal Centrifugal Pumps

820

LaBour Company, Inc., Elkhart, Indiana, has available an attractively bound 16-page booklet on **LaBour Horizontal Centrifugal Pumps.**

The booklet gives a concise presentation of important facts concerning a basic advancement in the pumping art, with a comprehensive description and explanation of the resulting equipment and its applications.

Described as a centrifugal pump capable of pumping either air or liquid or both the Hydrobalance

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pump primes without the use of valves, auxiliary pumps or other equipment.

Drawings of how the pump works, photographs of all models, typical installations, and with pump applications are also included.

Metallizing for Corrosion Prevention

821

Metallizing Engineering Co., Inc., Long Island City, N.Y., has available a paper that was presented by R. J. McWaters at the National Association of Corrosion Engineers Convention that discusses **Metallizing for Corrosion Prevention.**

The paper explains what Metallizing is, preparation of material to be Metallized, equipment used and the best types of metal to be used for specific corrosion problems. Several case histories are also included in the paper.

Insul-Mastic in Industry

822

Insul-Mastic Corporation of America, Pittsburgh, Pa., has just published a 44-page catalog entitled **"Insul-Mastic in Industry."**

The book describes Gilsonite base protective coatings, their properties, their uses and tests to which they have been subjected. Related products such as caulking compounds, primers and membraning material are also described.

As discussed in the book, Insul-Mastic coatings are used mainly to prevent corrosion of equipment—especially in chemically contaminated atmosphere; to waterproof buildings and to act as a weather barrier or vapor barrier over thermal insulation.

A special cork filled coating is also described in the book. This coating performs the double function of preventing corrosion and insulating. It is recommended for use in the atmospheric temperature range to prevent heat loss or to control condensation.

Diesel Engine Alarm and Shutdown

823

The National Supply Company's Engine Division, Springfield, Ohio, has just published an attractive 2-color bulletin on **Superior Alarm and Shutdown Control System.**

The bulletin describes wall and floor mounted cabinets incorporating the necessary alarm and shut down devices to safeguard the operation of stationary diesel engines. Also

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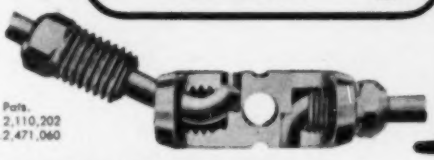

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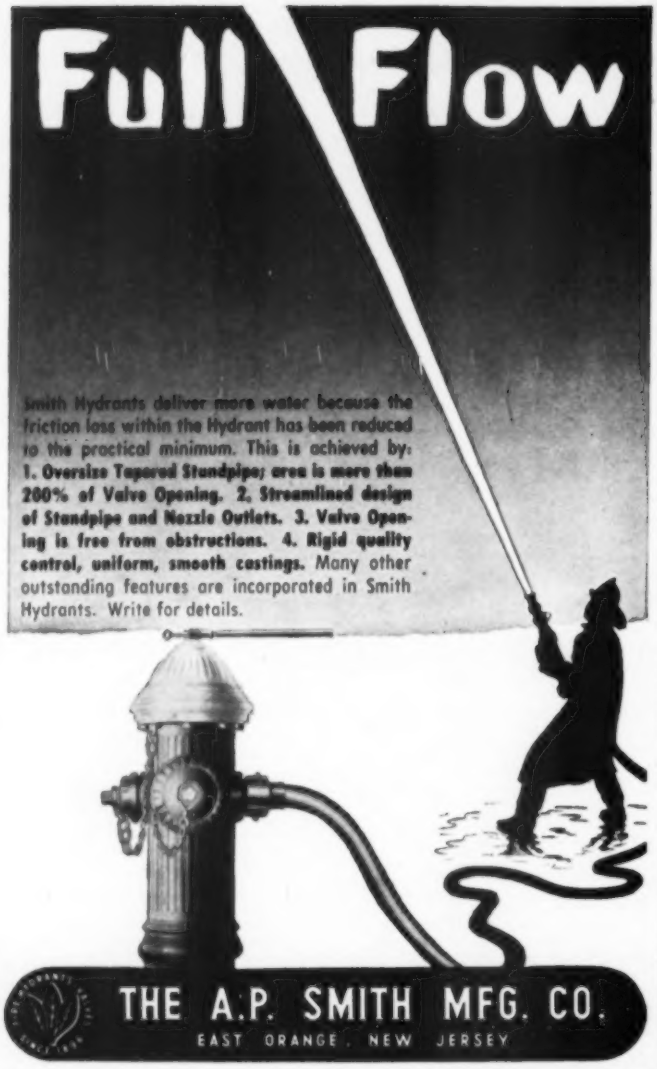
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listed are protective relays, signals, gages, etc., mounted on the cabinets and explains their operating sequences.

Bullclam Method of Sanitary Fill

824

Drott Manufacturing Corp., Milwaukee, Wis., has just published a booklet on **Sanitary Fill.**

This attractive booklet tells a complete story in pictures of a typical Drott Sanitary Fill in the first eight pages. Articles of other operations recently reported in magazines and newspapers are reproduced.

Comments from many officials of cities now using the Drott Sanitary Bullclam Shovel Method, plus a list of cities using the Drott Method are also included. A section devoted to operating costs for cities ranging in population from 4,000 to 400,000 completes the booklet.

Open Channel Meter Bulletin

825

The Bristol Company, Waterbury, Conn., has just published a bulletin describing the recently-announced Series 500 line of the company's **Open Channel Flow Meters.**

The bulletin describes the application of the instruments to the measurement of the flow of water, sewage, industrial plant effluent, irrigation water and other liquids through weirs and flumes of all types.

General Purpose Motors

826

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has just released a bulletin on **Squirrel-Cage Induction Motors.**

The bulletin describes construction features, ratings and dimensions of the company's open drip-proof and splash-proof squirrel-cage induction motors in ratings of ½ to 100 horsepower.

According to the bulletin, the motors are available with many special modifications such as totally-enclosed, vertical mounting, flange mounting, and multi-speed construction. All ratings are available in NEMA Design B, and most in NEMA Design C.

Iron Body Valves

827

American Valve Mfg. Co., Long Island City, N.Y., has made available a new catalog on **American Iron Body Valves.**

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

The catalog covers the company's line of gate and swing check valves. Photographs of each valve are shown along with line drawings and dimension tables. Illustrations of disc mechanism for the gate valves and parts of the gate and swing check valves complete the catalog.

Pipe and Tank Insulation

828

Pittsburgh Corning Corporation, Pittsburgh, Pa., has announced the availability of a new booklet entitled **"Foamglas Insulation for Piping and Process Equipment."**

This well illustrated 24 page booklet discusses the advantages of Foamglas, listing its properties, typical data for cold, intermediate, and hot applications, details for insulating tanks, ducts, removable covers, and tank heads, accessory materials, and distributors.

Tables in the new booklet which will be of value are those showing sizes and shapes of Foamglas available in pipe insulation, standard blocks, beveled lags, and standard curved segments, and recommended shapes and thicknesses.

Useful Tables of Conversion Factors

829

Dorr Company, Stamford, Conn., has available a pocket-size booklet of **Tables of Conversion Factors for Engineers.**

This handy little booklet, now in its 21st printing, provides a method for rapid and accurate conversion of the units of measure of one system into the different but related units of another system. All data are arranged alphabetically and unless designated otherwise, the English measures of capacity are those used in the United States, and the units of weight and mass are avoirdupois units.

Laboratory Air and Vacuum Pumps

830

Eberbach Corporation, Ann Arbor, Mich., has just released a new 2-color bulletin on **Eberbach Pumps For Air Blast or Suction.**

The bulletin states that the pumps designed for laboratory applications come either single or double mounted and the double mounted pump provides both pressure and vacuum independent of each other. This attractive bulletin gives complete performance and size specifications, suggested uses and illustrated descriptions of the unmounted and motor-mounted models.

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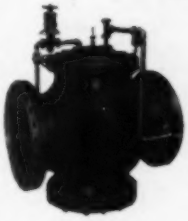

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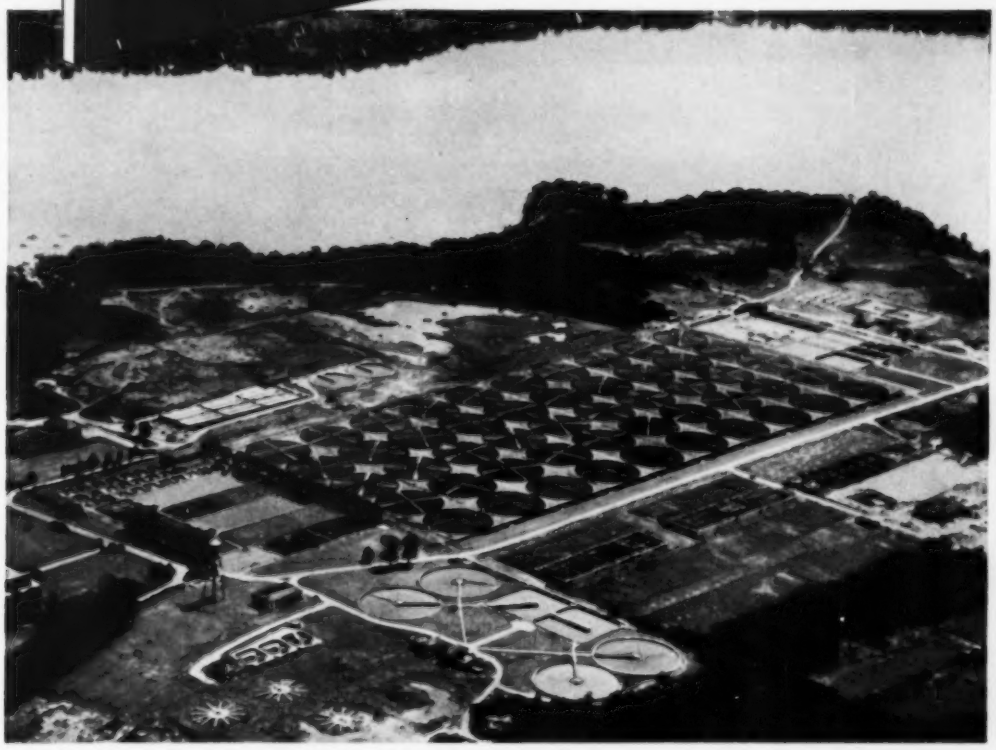

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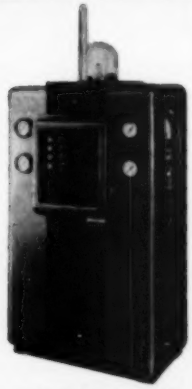

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